ILLUMINATING ENGINEER

XXVIII | February, 1934 | Price 9d.

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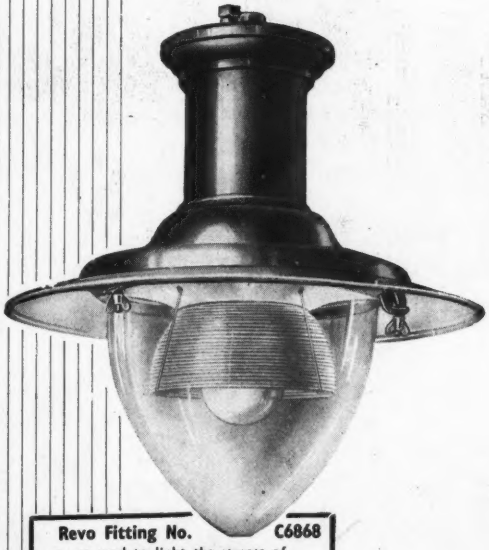

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Official Journal of THE ILLUMINATING ENGINEERING SOCIETY
FOUNDED IN LONDON 1909 INCORPORATED 1930

The ILLUMINATING ENGINEER

THE JOURNAL OF GOOD LIGHTING

Edited by

J. STEWART DOW

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Light Should Enable Us to See!

IT may seem a truism to assert that the essential object of artificial light is to enable us to see objects around us. Yet it is a fact that their lamps and fittings are often so used as to defeat this object. Simple steps necessary in order that the full value of the lighting may be secured are frequently neglected. This is specially evident in the case of outdoor lighting, when little help can usually be obtained in the form of reflection from surroundings. Indoors light from the walls and ceilings adds to the available illumination, softens the shadows and diminishes the effect of glare from any bright sources of light there may be. But out of doors we usually have to depend on isolated sources of light, situated a considerable distance apart and receiving little aid in the form of reflected light.

In such circumstances, therefore, it is well worth while taking a little extra trouble to assist the light in its task of revealing surroundings. Mr. Preston, in his admirable paper on dock lighting, points out one simple device—the use of whitewash, at the edges of quays or near projecting objects, so as to secure strong contrast. A metal bollard, almost indistinguishable in a feeble light when mounted on dark asphalt, is easily seen against a background of white concrete. Few people surely, even if the illumination is poor indeed, can have walked over the well whitened edge of a quay, which at once conveys a warning. During the recent fogs whitewashing the kerb of the pavement has proved a blessing, as the recent experimental "convoy-traffic" in Manchester has shown.

But this quality of contrast, so valuable when present in a moderate degree, becomes a danger when carried to excess. A very brilliant light amidst dark surroundings possesses such a high degree of contrast as to become a source of glare. A sudden glimpse of such a light in the gloom of a dockyard dazzles the eyes so that their owner must be wary for several minutes afterwards. In the streets the effort to avoid glare from public lamps and yet to secure reasonably uniform illumination is notoriously difficult. Compromise in such cases there may have to be, though we ourselves would always lean towards avoidance of glare, even at some cost of uniformity.

Light, like fire, is a good servant but a bad master. *We* should be the masters—but good masters, careful to remove all needless obstacles to efficient illumination.

In what has been said above we have referred mainly to outdoor illumination—for it is chiefly out of doors that the disadvantage of glare is so evident, and the value of moderate contrast so great. But in the case of indoor installations—in the home, office and factory—the same principles hold good, and we shall endeavour to illustrate this in our next issue.

The Lighting of Docks
(See page 39)

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Light and Publicity
(Developments Abroad)
(See page 55)

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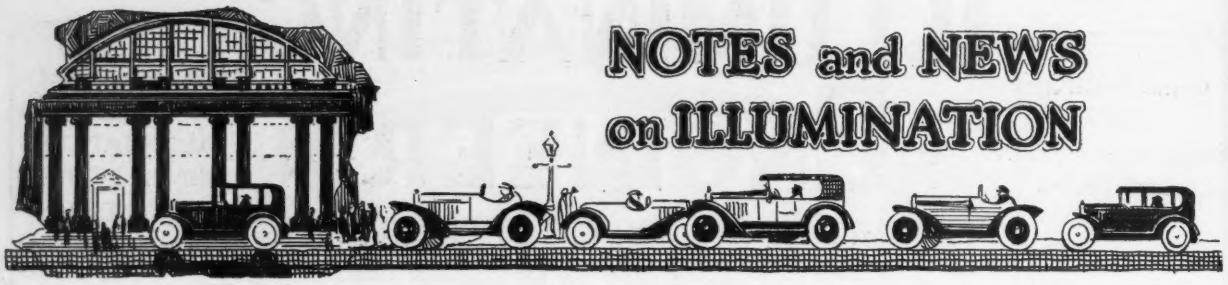
Problems in Public Lighting
(See page 51)



Scholarship Improved by Light

The lack of data illustrating the actual benefits of better lighting in schools has long been a difficulty, for how, without such data, can a satisfactory scientific basis for standards be found? Therefore much interest attaches to an experiment recently described by Mr. F. C. Albert* at the Twenty-seventh Annual Convention of the American Illuminating Engineering Society. Two similar adjacent schoolrooms were differently treated. In one room (A) the artificial illumination furnished by the existing system varied from 2 to 6 foot-candles and was controlled by hand in the ordinary way. In the second room (B) the lighting was controlled by a photo-electric relay set to switch on the artificial light whenever the natural illumination fell below 12 foot-candles. An illumination of not less than 12 foot-candles was thus always available. As a result the lights were burned for only 8.5 to 14.7 per cent. in different years in Room A, as compared with 32.6 to 38.3 per cent. of school-hours in the Room B. Both rooms were each occupied by typical classes by whom the same character of work was done. At the end of the year the same examination test was applied. The first year's test revealed 4 failures out of 36 pupils in Room B, as compared with 11 failures out of 34 pupils in Room A. In a second year, when there were 42 pupils in each room, there were 3 failures in Room B, as compared with 11 in Room A. Results in the same direction were shown in a third year's test. The conclusion is drawn that success in examinations depends on the adequacy of the illumination. Recognition of this fact should surely lead to a general demand for better lighting in examination rooms!

Ancient Lights

The collection of ancient forms of lamps is a fascinating hobby. The late Mr. Johnstone, of Hendon, had a marvellous collection, on which he lectured to the Illuminating Engineering Society on one occasion and there are still one or two members of the Society who have gathered together a number of specimen lamps of different ages. One is interested to notice that this subject is being taken up with great zest in the United States, where a body devoted to this special object and known as the " National Rushlight Club " exists. The founder of this club, Dr. Edward A. Rushford, of Massachusetts, was recently responsible for a series of fifteen lectures on lighting, illustrated by specimens of his collection, stated to be the largest of its kind in the United States.

* Trans. Ill. Engs. Soc. U.S.A., Dec., 1933, pp. 866-875.

Architects Confer on Lighting

A series of lectures on aspects of lighting of interest to architects, similar to those which have been so successfully organised by the E.L.M.A. Lighting Service Bureau in past years, was commenced last month on January 17, when Mr. W. J. Jones gave the first of the series on " Lighting Principles and Economics." Mr. H. C. Wheat followed on January 31 with " Church Lighting." During this month the subjects are: Lighting for Shops and Stores (Mr. R. O. Ackerley, February 14) and Industrial Lighting (Mr. H. A. Lingard, February 28). The two final lectures in March, by Mr. R. O. Sutherland on " Lighting in Interior Decoration," and Mr. F. G. Quance on " Designing Facilities for Installing Light," should prove of special interest. The latter emphasises a number of points in design which are of fundamental importance to lighting engineers but are sometimes overlooked in architectural treatment. The excellent plan of inviting architects to open the discussion at each meeting is again being followed. Amongst those so acting we notice Mr. C. H. James, Mr. M. E. Webb, Mr. C. Lovett Gill, Mr. G. Grey Wornum and others whose names are already familiar as being keenly interested in illumination.

The Menace of Fog

The series of tragic accidents to aircraft caused by aerial masts and other unseen obstacles and the accident on the French Railways—the most disastrous for many years—have seemed to bring home the dangers of fog. Fogs and mists, especially when united to darkness, constitute a most baffling phenomenon, which may well render almost any system of lighting ineffective. Experience seems to show that no very marked advantage is secured by using light of any special colour. Nevertheless, in all but the densest fogs, vivid brightness, distinctive colouring or " flashing " of lights do serve as valuable marks of identification. Certainly the marking out of wireless masts, pylons and other similar obstructions in this way has become an urgent necessity and will no doubt receive much more serious attention from now onwards.

Dense fogs, such as those recently experienced, are apt to paralyse city traffic. In Manchester the problem has been attacked by new methods. Edges and kerbs of important routes were whitened wholesale. Special vans, throwing a strong amber beam on these white edges and equipped with powerful red lamps behind, acted as convoys to motor traffic, apparently with signal success.

TECHNICAL SECTION

COMPRISING

Transactions of The Illuminating Engineering Society and Special Articles

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

The Illuminating Engineering Society

Notes on Recent Meetings and Events

AS will be seen from the accompanying list of forthcoming events, the present month is destined to be a busy one for the ILLUMINATING ENGINEERING SOCIETY. We allude more fully to these various items on the following page. Our first task is to record the last General Meeting in London, which took place in the Lecture Theatre of the Institution of Mechanical Engineers on Tuesday, January 9th.

Members assembled for light refreshments at 6.30 p.m. and the Chair was taken at 7 p.m. by MR. A. W. BEUTTELL (Vice-President), who officiated in the absence of The President (Mr. A. W. Sully), owing to an urgent engagement elsewhere.

The Minutes of the last meeting having been taken as read the HON. SECRETARY read out the names of new applicants for membership whose names appear below. The names of those announced at the last meeting were read again in accordance with the usual procedure, and these applicants were formally declared members of the Society.*

Applications for Membership.

Country Members:—

Daniel, R. W. .....H.M. Inspector of Factories, Norfolk Street, SHEFFIELD.

Hughes, K. M. .....District Manager, Revo Electric, Ltd., 13, Ash Grove, Timperley, CHESHIRE.

* ILLUMINATING ENGINEER, January, 1934, p. 3.

Forthcoming Events

Tuesday, **Feb. 13th.—The Annual Dinner** will take place at the TROCADERO RESTAURANT, Piccadilly, London, W.C. **7 for 7.30 p.m.**

Tuesday, **Feb. 20th.**—A paper will be read by MR. H. BUCKLEY on **Heterochromatic Photometry:** with particular reference to Luminous Discharge Lamps and will be followed by a discussion. The meeting will take place in the Hall of the Institution of Mechanical Engineers (Storey's Gate, St. James's Park, London, S.W.1) at **6.30 p.m.**

Thursday, **Feb. 22nd.**—A Special Meeting will be held at the British Industries Fair, Birmingham, at **3 p.m.**, when an address reviewing Progress in Illumination and the Lighting Industry will be delivered.

Mr. Cunnington's Paper.

MR. A. CUNNINGTON then delivered his paper on "Portable Lamps and their Applications," which contained an up-to-date review of self-contained and portable illuminants, including lamps operated by acetylene, paraffin, and portable electric batteries. The paper was concluded by a survey of practical applications of such lamps, which are particularly widely used in connection with docks and railways. Of special interest is the applications of high candle-power flares of this description for the illumination of large outdoor areas where work is proceeding by night. The author also presented a useful table giving the average candle - power, fuel consumption and cost per 1000 candle-hours of the various systems. The paper was illustrated by numerous lantern slides, and also by specimens of the equipment described, which were closely examined by the audience at the conclusion of the lecture. A cordial vote of thanks to the firms responsible for this display was passed.

Discussion.

The paper led to an interesting discussion in which the following took part: MR. W. A. WILOX, MR. A. H. STEVENS, MR. C. S. MILNE, MR. H. LONG, MR. J. R. HEPPLE, MR. A. BARRAT, MR. J. S. DOW and MR. P. S. BARTON.

MR. CUNNINGTON replied to the discussion and a very cordial vote of thanks to him for his interesting paper terminated the proceedings.

(Mr. A. Cunnington's Paper and the ensuing Discussion will appear in full in our next issue.—Ed.)

FORTHCOMING EVENTS

Special Meetings in Birmingham.

In Birmingham matters are not so far advanced as in Manchester, but there is already a nucleus of local members which should ultimately enable a local section to be established.

Two forthcoming meetings in Birmingham should help to pave the way for this step. On February 22 (the date when members of Council of the Illuminating Engineering Society are invited to luncheon at the British Industries Fair) a Conference will take place at the Fair at 3 p.m., when an address dealing with recent advances in the art of lighting and possible future developments in the lighting industry will be delivered. This is not primarily an effort addressed to Birmingham, but rather an attempt to interest exhibitors and visitors to the Fair, who will come from all parts of England.

The second meeting will be arranged in Birmingham about the middle of March on similar lines to the meeting held in the same month in Manchester mentioned below. This meeting is intended specially for people in Birmingham and the Midland area, and an attempt to increase substantially the membership of the Society in this area will be made.

Forthcoming Meetings in Manchester.

As announced in our last issue, a Special Meeting was arranged to take place in Manchester on January 30, when Mr. H. R. Ruff had kindly consented to read a paper on Electric Discharge Lamps.

We now learn that another special meeting has been arranged to take place in Manchester on March 15. That meeting will be organised in somewhat the same manner as the Opening Meeting of the Session in London—that is to say, there will be a series of exhibits illustrating progress in illuminating engineering, an address summarising recent advances, and dealing with the work of the Illuminating Engineering Society.

The local section in Manchester is thus showing great activity, and is providing a very creditable programme for the present session. Engineers in the north-west area who are interested in lighting can obtain from the local hon. secretary (Mr. James Sellars, Highways Dept., Town Hall, Manchester) further particulars of meetings, and forms of application for membership if they wish to join the Society—as we hope many of them will do.

The Annual Dinner.

Members are reminded that the Annual Dinner will be held at the Trocadero Restaurant, Piccadilly, London, W., at 7 for 7.30 p.m., on Tuesday, February 13. Members should make a special effort to be present this year (the twenty-fifth year of existence of the Society). Any who wish to attend but have not yet done so should apply at once to the Hon. Secretary for tickets.

"Affiliated Students."

A step recently announced by the Council of the Illuminating Engineering Society is of considerable interest to students at technical colleges or others between the ages of 16 and 21 who are in the employ of firms in the lighting industry, or are in any way interested in lighting.

In future such persons (of either sex) are free to apply for registration as "Affiliated Students" of the Illuminating Engineering Society, at the very moderate subscription of only half a guinea per annum.

Affiliated Students will be entitled to attend meetings, to take part in visits, and to receive all the usual notices and copies of THE ILLUMINATING ENGINEER monthly.

They will thus have every opportunity of becoming familiar with what is happening in the lighting industry, and equipping themselves for employment in this field if they so desire.

Forms of application may be obtained on application to the Hon. Secretary (Mr. J. S. Dow, 32, Victoria-street, London, S.W.2). (The arrangement, it should be clearly understood, relates only to people between the ages of 16 and 21. Those over 21 years of age should, of course, apply for membership in the Society under ordinary conditions.)

How Members Can Help the Society.

We are asked to mention that several ways in which members can help the Society at the present time, namely (1) by inducing others to join; (2) by making widely known the forthcoming meetings in Manchester and Birmingham; (3) by offering papers, especially those describing original work; (4) by participating in investigations and researches such as are about to be initiated by the Technical Committee, and (5) by making the work of the Society known by means of contributions to the daily or technical Press, or by giving papers and lectures before kindred societies or organisations interested in some specific phase of lighting.

There is ample room for effort in all these five fields by the younger members, who should count it a privilege to be able to advance the interests of the Society with which they are associated. Will any who are willing to serve in these ways kindly send in their names to the Hon. Secretary.

Elections of Council and Officers.

In our next issue the usual notice in regard to Retiring Officers and Members of Council, and nominations made by the Council, to fill vacancies will appear. (Copies of this notice will also be circulated direct to members of the Society in due course).

The Lighting of Docks*

By J. S. PRESTON, M.A., A.Inst.P.

(National Physical Laboratory).

ABSTRACT.

The paper summarises general principles of lighting as applied to docks, and suggests solutions of the various special problems encountered.

Such questions as spacing and choice of fittings, maintenance and efficiency, glare, the effects of whitening interior and exterior sites are discussed. Finally, attention is drawn to the physiological and psychological aspects of good lighting.

THE general survey of dock lighting recently undertaken by the Department of Scientific and Industrial Research is one of the latest indications of the growing recognition of the part which lighting, especially artificial lighting, plays in the ordinary affairs of life, and of the close attention which it therefore merits on the part of those intent on improving the lot of mankind. The newer uses of artificial light, such as the control of traffic by coloured signals, the safeguarding of property in conjunction with the light-sensitive cell, or therapeutic purposes, may claim our interest by their novelty; but there is still much to be learned about the use of artificial illuminants for the primitive purpose of making objects visible. The interest here lies in the many things which we now include in that word "visible." The subject of the present paper is eminently suited to bring into prominence most of these many aspects of the problem on account of the great variety of situations met with.

The use of artificial lighting on docks may have one of a number of different objects. These vary between the mere indication of a pathway by beacon or pilot lights and the continuation after dark of processes requiring a relatively high degree of illumination. In this range of objects will be included the lighting of points where special danger may be encountered. For the present purpose we shall divide the various sites to be considered into two groups, namely, those requiring general lighting such as approaches, warehouses and quays, and those where the installation must be of a more highly specialised kind, such as graving docks, swing bridges, lock gates, dock entrances, cranes, granaries, coal-handling machinery and the decks and holds of vessels.

LIGHTING OF APPROACHES.

We shall study the problems set by these varied sites and how they may be met, then consider some of the general questions relating to all installations, and finally touch briefly on the actual values of illumination used and recommended.

The lighting of road and rail approaches to docks presents all the problems associated with street lighting with one or two important additions. There should be an adequate degree of illumination for the traffic in question, with a suitable degree of uniformity and absence of glare. Also, apart from traffic requirements, it is important that the level of illumination should permit of adequate supervision, and, further, that owing to the frequent proximity of railway tracks to roads and footways a larger safety factor is necessary than would be the case for either separately.

As regards uniformity of illumination there has been a tendency in street lighting to lay stress on uniformity on the horizontal plane. Now the more obliquely the light falls upon this plane—the road surface—the more intense must be the beam to give the same observed illumination. Moreover, the most oblique incidence is at the spots midway between the individual lighting fittings, so that directional street lighting fittings are designed to have a higher candle power in such a direction than in directions nearer to the vertical. The attainment of *uniform* illumination on a horizontal plane by this method is, however, probably not desirable, much less essential, particularly where lighting units are widely spaced. For the high intensity of the oblique beam illuminating the mid-point of the span will result in an emphasis upon the elongated shadows of objects at this position as compared with the shorter, less noticeable shadows of objects more nearly beneath the unit,—so that moving vehicles will be accompanied by rather definite shadows which elongate and contract in a disconcerting way. Moreover, the brightness of an object depends on the intensity of the source in its direction, and, of course, on its distance from the source, rather than on the illumination on the horizontal plane.

We thus reach the conclusion that the ideal fitting in this respect is one whose candle power in any direction bears a constant ratio to the square of its distance from the ground in that direction—that is, a fitting which gives constant illumination on a plane at ground level, squarely facing the light.

Again, there is the question of glare. Glare increases with the intensity of the source, and decreases as the direction of the source becomes more oblique to the line of vision. Thus, on this score also, the unit giving a high intensity in directions near the normal line of vision of a pedestrian is not to be recommended. It follows that in order to maintain adequate illumination near the middle of a span, without dazzling effects, the spacing-height ratio of the system—i.e., the ratio of the distance between successive units to their height above ground level—must not be too great.

Thus, taking everything into consideration, the ideal lighting system for dock approaches would consist of units situated not too far apart, say, not more than about six times their height, and giving, as a system, an illumination on the horizontal plane not varying in a ratio of more than, say, five or six to one along the line joining the units. The actual units may consist of refracting or reflecting fittings suitably designed for the particular dimensions used; or the British Standard Industrial fitting may be used. The actual illuminant may be gas or electricity. Where gas is used the type of burner having a number of mantles in a row is useful. It is a simple matter to

* (Paper read at the Special Meeting of the Illuminating Engineering Society, held in the Showrooms of the Liverpool Corporation Electricity Department, 9/11, Whitechapel, on Wednesday, December 6, 1933, at 7.15 p.m.)

adjust mirrors beneath the mantles to augment the illumination midway between units. The outstanding advantage of the Standard Industrial Reflector is that it can give a complete cut-off of the light from a unit at a specified angle below the horizontal. On page 15 of the D.S.I.R. Illumination Research Technical Paper, No. 14, some details of an installation of Standard Reflectors are given. Each unit contained a 300 watt gas-filled lamp and was mounted at a height of 26 ft. 6 in. The spacing between units was 130 ft., giving a spacing height ratio of about five. Although this ratio is by no means high, the illumination on the ground plane varied from 0.05 foot-candle to 1.21 foot-candle. This diversity is, of course, accounted for by the non-directional quality of the reflector. As is pointed out in the paper, however, by raising the height of the fittings two fold, the minimum and maximum illuminations on the ground become 0.13 and 0.30 foot-candle respectively. Not only is the diversity reduced, but the general illumination is less oblique to the ground plane. However, the disadvantages of this reflector as regards its non-directional quality are largely outweighed by the complete cut-off, which in the case considered was at 20° below the horizontal—that is, from the foot of each standard only the next adjacent lamp could be seen directly. Glare was thus almost non-existent.

This subject of approach lighting has been treated at length because the general principles involved enter into the consideration of almost every other lighting problem we shall mention. It remains to consider a few actual facts concerning the existing state of affairs. The most frequent fault with existing installations is probably that the units are spaced too widely, or, what is equivalent, they are mounted too low. Raising the height of an installation need not necessarily be wasteful of light if suitable fittings are employed.

There is also a tendency, natural enough, to concentrate attention on the lighting of points whose increased illumination leads to increased output by the dock worker. The question of safety is, however, important to a special degree on dock sites, where the hazards are rather more numerous than, for instance, in the ordinary street, free as it is from railway tracks, unlighted obstacles and the like.

Over against the adverse criticism of present systems of approach lighting may be set the many successful attempts at flood-lighting large areas of road and railway. The success here is due mainly to the facts that when one contemplates flood-lighting one immediately thinks of special fittings mounted almost as high as possible, and the two main requirements of successful outdoor lighting are thus almost instinctively embraced. A special application of flood-lighting of railway areas must be noted. It is the case where large steelwork such as rails and girders is conveyed direct from ship to railway wagon. Owing to the unusual length of the goods and the risks associated with the transhipment, the more usual systems of quay, crane, or approach lighting would be unsuitable.

WAREHOUSE LIGHTING.

The second subject for consideration—Warehouse Lighting—is equivalent to factory lighting for non-fine processes. The mounting height of fittings is limited and the distribution of illumination is affected by the type and spacing of units and also the state of walls and ceiling. The subject of factory lighting has been studied exhaustively in the past, and comment is necessary only on two respects in which many present installations might be improved. First, there is the question of the spacing of units. In general, for economic reasons, there is a tendency to underestimate the number of units required for a given warehouse. Not only is the capital expenditure on fittings thus reduced, but advantage is taken of the fact that one unit of large consumption is usually somewhat more efficient than several smaller ones. The capital charge is, however, the main expense connected with the use of smaller, more numerous, units, and it limits the extension of a principle so desirable on other grounds.

Second, there is the question of the state of walls and ceiling. Where it is at all possible to whiten walls and ceiling this is a distinct advantage. Where it is not possible, the type of fitting used should be more carefully chosen, because there will be no bright background to minimise glare from the units, light allowed to reach walls and ceiling will be largely lost, and the advantage of diffusion by white surroundings will be absent. The subject of whitewashing will be considered later, but it may be of interest to quote a case met with during the recent investigation on dock lighting. A warehouse, 330 x 90 feet, was whitewashed (or finished with a light cement) and lit by forty-two 100-watt lamps in standard industrial reflectors. The mean illumination on the working plane (2 feet 9 inches above floor-level) was nearly one foot-candle and the maximum illumination was only three times the minimum, neglecting small corners and a few unavoidable obstructions. This case was notable both for the white walls and ceiling and for the large number of units employed. The result was of an exemplary kind. It is true that other installations exist in which a similar standard of excellence is reached, but they are by no means as numerous as might be desired.

There remains one point which may be mentioned, and it is a question of mathematics rather than higher criticism! Where a warehouse is lit by rows of lamps each row is often staggered with respect to its neighbour so that its lamps come midway between those of adjacent rows, as measured from the wall of the building. The excuse is that a better distribution of illumination is obtained thus; but there is the added inducement that one unit is saved on every alternate row. [If the warehouse is not square the reader may decide whether the total number saved is obtained by counting rows along the warehouse, or across it.] It is, however, a fact that the total number of lamps in a staggered system is intermediate between the numbers in the two " squarely " planned systems nearest to it as regards spacing of lamps. Staggering can, therefore, be regarded simply as a scheme for using some prearranged number of units to the best advantage. Certainly economy in the number of units employed is generally the deciding factor in the adoption of a staggered system.

QUAY LIGHTING.

Quay lighting on the other hand is seldom carried out on such a lavish scale as to lead to quibbles about staggering. In fact, it is a matter of dispute whether it can strictly be called a lighting problem at all. In the main, no doubt, the function of quay lighting is to outline the form of the quay to shipping, and one 40 or 60-watt lamp every forty yards or so is sufficient for this. If, on the other hand, the quay is used by pedestrians after dark, much more plentiful illumination would be necessary to offset the obvious dangers of the situation such as bollards, cables and the like. Omitting then the question of beacon or pilot lighting as outside the scope of the illuminating engineer, inquiry may be made into the problem of lighting economically a long narrow strip of ground for purposes of ordinary traffic. This may be done as a matter of interest without prejudice to the decision as to whether or not a quay should be used after dark by the dock worker for incidental purposes.

The limitations upon a quay lighting system are set by the surroundings. Especially is it necessary that units shall not project so as to foul crane loads or cables. Moreover, glare from the quay lights must not

interfere with the perception of swinging loads. On the other hand, the warehouse provides facilities for mounting units as close together as may be desired. The possible systems would seem to be a closely spaced row of low wattage units with no special directional properties, or a more widely-spaced row of special directional units, or thirdly, perhaps, an arrangement of narrow angle floodlights mounted at a large spacing and nearer ground level than usual. The special directional units in the second system would have to be such as to concentrate almost the whole available light from the lamp in two opposing directions. Something similar to prismatic bulkhead fittings might serve this purpose. The floodlighting system need not be extravagant in power consumption. It is suggested here because it would enable most of the useful light to be directed along the quay, it would throw long and obvious shadows of obstructions, and there would be little glare in the overhead direction to add to the dangers of crane working.

It is common practice to augment quay lighting by means of portable cluster lights for handling cargo. These clusters are clearly a necessity in many cases and no rules for their employment can be laid down, but augmentation of the quay lighting by a permanent working installation suitably sectionalised would add much to comfort, safety, and, maybe, also efficiency.

Graving docks are rather a law unto themselves and present dangers of an unusual kind, such as unprotected stairways down the side of the dock. It is difficult to give any guiding principles beyond the general one of plenty of light at the dangerous spots. Floodlighting may be useful to give a wholsesome sense of perspective.

MISCELLANEOUS PROBLEMS.

Swing Bridges and Lock Gates.

Swing bridges and lock gates generally require a higher degree of illumination than their surroundings, the former on account of the fact that they constitute part of a roadway, and are often channelled along the wheel track of vehicles; the latter because of the dark nature of the wood- or iron-work of the gates. For the sake of safety red lights should show in the direction in which a swing bridge is closed to traffic. These sites, however, raise no special problems of their own.

Dock Entrance Gates.

Dock entrance locks, on the other hand, present a case for special treatment in the necessity for ensuring a minimum of glare to those on board ship, while amply illuminating the quays and the obstacles thereon. It is at once clear that fittings with a definite cut-off are demanded, unless the mounting height is so great that glare may be avoided by so keeping the light sources well out of the line of vision. A good deal of attention has been devoted to both alternatives by fittings manufacturers. The units intended for a mounting height round about forty feet are designed to concentrate light in the downward direction so as to eliminate wastage at the edges of the system and also to avoid high intensities in directions in which glare may be experienced. Units giving a reasonably uniform and high illumination at a somewhat lower mounting height are designed to combine a complete cut-off at a rather low angle with sufficient concentration of the light just below the cut-off to illuminate adequately the mid-point of the span. Such a combination naturally requires that the units be mounted strictly in accordance with the maker's intention as regards spacing and height. Otherwise a particularly patchy illumination may result. An installation of this last type, recently examined, gave maximum and minimum illuminations on the ground plane of 0.41 foot-candle and 0.18 foot-candle, while there was a notable absence of glare.

It is desirable in the case of entrance locks to give special attention to the uniformity and adequacy of the illumination along the quay edge. It is not usually possible to mount units very close to the water owing to the obstruction they would present to the management of traffic through the lock. There are, however, many obstacles, such as bollards and hydraulic or electric control levers, to trap the unwary. Since ease of perception is a function of the amount of contrast in light and shade presented by an object, such obstacles may be painted with black and white rings to enhance their visibility. The use of white cement wash on the quay edge is also most valuable as an aid to safety. Too often the stone coping is almost indistinguishable in tone from the water itself.

LIGHTING ON BOARD SHIP.

Lighting on board ship formed only a small part of the investigation already mentioned, and really forms a separate subject. Mention may be made of the suitability of high wattage deep enamelled fittings mounted high above the derricks for the handling of cargo. Work in the hatchways and between decks is usually lit by portable clusters also. In passenger vessels with deep trunk hatchways these are frequently whitened, and the light well thus formed diffuses and economises the light. Regular lighting systems between decks in the holds of vessels would be a great improvement on the present general state of affairs. However, the possibility of damage by cargo, with perhaps a fire following, are serious disadvantages. Again, for the purpose of trimming coal in bunkers and on board colliers, it seems impossible to dispense with hand-lamps of some sort. Candles are still widely used for this purpose.

GRANARIES AND COAL-HANDLING PLANT.

Cranes, granaries, and coal-handling plant present features of a special character markedly different from those associated with installations related more nearly to factory or street lighting. Taking *granaries* first, this is a case where the presence of machinery and chutes upsets all attempts at a normally-planned lighting system. Further, dust rapidly collects upon any type of fitting which may be used. A large number of low wattage bare lamps, preferably internally frosted, may be used, and this will generally be the best that can be achieved in the circumstances. The presence of light-coloured dust everywhere helps to minimise the glare from bare lamps. On some of the upper floors of granaries, where conveyors run near the ground, and there are few obstructions above (except, perhaps, the ceiling itself!), it is sometimes convenient to mount enamelled reflector fittings below eye-level. The moving machinery is thus made particularly noticeable. Where overhead obstructions are not numerous, the standard industrial reflector is useful, and easy to keep clean in the dusty atmosphere. In addition to the general lighting system, a large number of special points in the neighbourhood of machinery will be required.

Coal-handling plant is of such dimensions as to warrant the use of floodlighting units of fairly high wattage. The low reflection factor of coal, and the rapid accumulation of coal dust on fittings between cleanings, makes a generous estimate of illumination necessary. Cleaning should be more frequent than for other situations. The coal-handling machines themselves afford support for some of the units, while the others necessary to illuminate railway tracks and feeders should be mounted on high standards, in suitable positions. The use of floodlights on high standards is advisable in all cases where minerals are dealt with in bulk, or where the material handled is of considerable size, as in the case of steel rails and girders.

CRANE LIGHTING.

Crane lighting is a subject in which a particularly close association exists between degree of illumination, or, rather, suitability of illumination, and safety. In this case the obstacle is moving and the man is fixed, it may be said. Crane lighting is not fundamentally independent of quay and hold lighting. All three systems contribute to the illumination on the load in its various positions. There is a difference, however, in that the crane system moves with the load, while the others do not, and attention will here be given only to the contribution of the system on the crane to the total effect, and with the technical problems associated with the situation and movement of the system.

Generally, a crane lighting system consists of a cluster of four 60 or 100-watt lamps in an enamelled reflector at the mid-point, or a point of trisection, of the jib, and perhaps one or two single lamp units on the base of the crane, independent of luffing and slewing. Jib lights not only illuminate the load, but also serve to show the position of the jib. The latter is a particularly useful function when a crane is being operated by remote control. From the illumination aspect the main function of the jib light is to show the position of the load in the hoisted position. It is usually too high to give much illumination at ground level. Should this disadvantage be overcome by increasing its candle-power, glare at once becomes troublesome. Jib lights are most useful in the case of cranes with fixed jibs at a fairly flat angle.

It is generally stated that the main points requiring adequate illumination are the points of lift and drop of the load; and on the quayside at least it is desirable to be able to see the hook and sling while lowering. It is not always deemed necessary to have a high general illumination in the neighbourhood of the jib, for the avoidance of obstacles, because slewing and luffing are usually carried out with the assistance of indicators after a preliminary trial swing. Damage to the jib through collision with an obstruction is frequent enough however to suggest that sufficient illumination should be provided. Theoretically in crane lighting one meets at the outset two opposing points of view, that of the crane driver and that of the worker below on the quay. Lights on the crane may be a source of glare to those below while cluster and other lights on the quay may interfere with the driver's vision in that direction. The smaller the number and intensity of light sources directly visible from quay or crane, the better the conditions as regards glare and danger. To obtain adequate illumination subject to this condition constitutes the fundamental difficulty associated with crane lighting.

It is desirable to have sufficient illumination on the load at such a height above the quay that the arrival and position of the load may be apprehended from below before it has descended within the region of the general quay lighting. In addition the crane driver may require to see the load in the hoisted position. The sources of light necessary for these two purposes should be invisible to driver and quay worker. The double purpose and the double requirement may perhaps be met by a single system consisting of one or more very narrow angle projectors mounted on a cradle at the jib head, so as always to maintain their axes vertical. These projectors will direct a narrow beam of light vertically downward on to the load in all positions, and the sharp shadow on the ground will assist the driver to judge the height of his load from the ground. A supplementary fitting on the jib will show the driver its position. The total consumption of such a system need only be about 200 watts, say, 100 watts in the projectors and 100 watts in the supplementary fitting. This system appears to have many advantages and few drawbacks. Alternatively, illumination in the region above the quay lighting might be provided by means of a special projector situated on the revolving part of the crane at the base of the jib but not luffing with it, and giving a fan-shaped beam spreading upward from the level of the top of the warehouse door nearly to the vertical. This system would not, however, emphasise the load so strongly as would the previous one.

The present-day jib light can almost certainly be replaced by a better crane lighting system, but careful thought and experiment is needed on this difficult subject to arrive at an entirely satisfactory arrangement.

SOME GENERAL PROBLEMS IN DOCK LIGHTING.

Particular sites having been considered, place may now be found for a more general discussion of dock lighting and associated subjects. Much attention has recently been devoted to the subject of glare, and investigation has revealed that from the point of view of " seeing-power," and also of safety, glare may very considerably reduce the value of a lighting system which may be satisfactory on other grounds. The word glare is used in two rather different senses. Sometimes it denotes the reduction in the sensitivity of the eye to contrasts in brightness, due to the presence of bright sources of light in the field of view; or it may denote the physical discomfort produced by the glaring sources. Such a separation may not be justifiable physiologically, but the two aspects of the subject are amenable to separate measurement and consideration.

Visibility glare, or the reduction in contrast sensitivity due to a glaring source of light increases with the intensity of the source and falls as its distance from the observer increases. It also falls with increase in the angular distance of the source from the point on which the attention of the eye is focussed.

The degree of glare to be expected in a given case can be calculated from such data. Glare of this type is best avoided by using fittings having a definite cut-off, or at least a sufficient drop in intensity in directions near the horizontal. It cannot be too strongly emphasised that increase in the mounting height of outside systems, coupled with suitably designed units, can frequently lead to marked improvement not only as regards glare, but also on account of the improvement in distribution of the light.

The physical discomfort arising from glare is not easily estimated quantitatively, but it is definitely reduced by the presence of a continuous light background behind the glaring sources, though such a background has little effect in reducing the degree of visibility glare. In warehouses where the height of units is limited a white ceiling is a marked advantage in reducing discomforting glare, and in conducing to cheerfulness of aspect. The economy resulting from whitewashing walls and ceilings is dealt with later.

The spacing and height of units is one of the primary factors to be decided in the design of a lighting installation. The candle-power distribution of the fittings required to give the specified illumination will depend on the spacing-height ratio. As already pointed out, the closer the spacing can be made, the better, since the cut-off of each unit may be lower and glare will be reduced. Moreover, the candle-power distribution of each source will not need to be of so specialised a type. On the other hand, if a large spacing is adopted, special directional units will be necessary to achieve adequate illumination, and the disadvantages of oblique illumination already mentioned will be apparent. Needless to say, increase in height has a similar effect to decrease of spacing except at the edges of a system where wastage may occur if due allowance for the spread of the light is not made in the design of the installation. As a general rule we may say that the spacing-height ratio should never exceed 12, and should seldom approach this figure. The ratio should not exceed 4 if simple dispersive fittings such as the standard industrial are employed.

The choice of suitable fittings involves consideration of candle-power distribution, efficiency, maintenance, and first cost. Financially, first cost is probably the

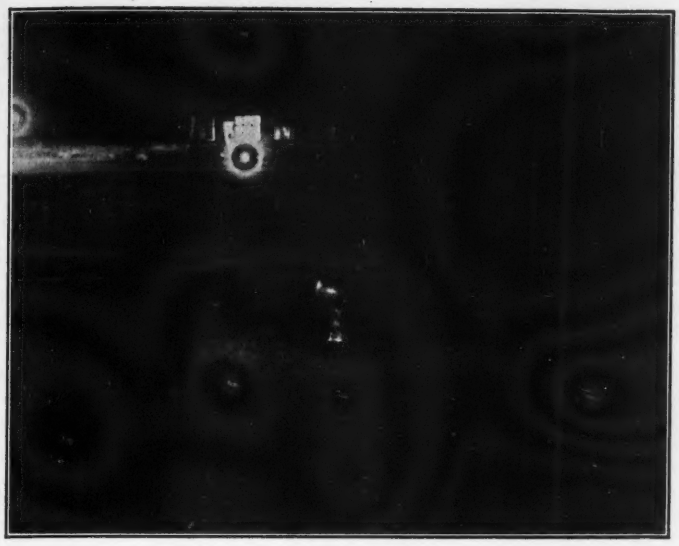
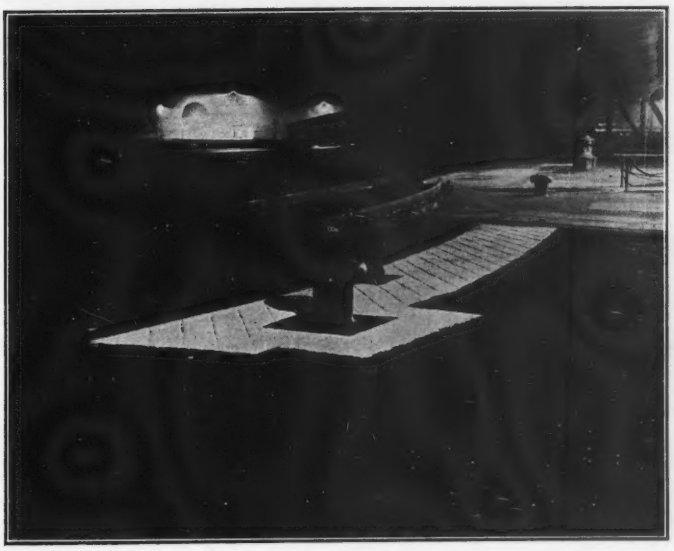


Fig. 1 shows an iron bollard in ordinary concrete surrounded by gravel and ashes of a dark tone. The bollard would be very indistinct but for the reflections on its shiny surface. The contrast, on its right hand side, with the black ashes is very poor.

Fig. 2 shows a typical site in the neighbourhood of lock gates, treated with a wash of white Snowcrete cement. The bollards in this case are clearly revealed by contrast with the light surround.



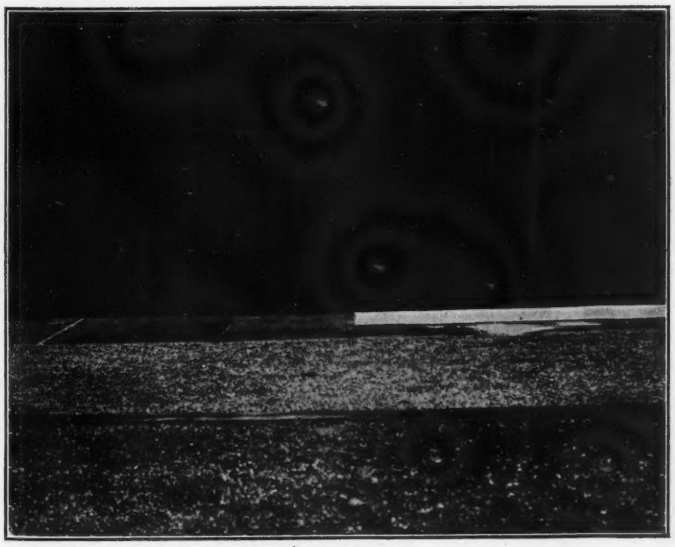


Fig. 3 shows a strip of grey granite coping above an entrance lock, one half of which has been treated with Snowcrete cement wash, the other half untouched. The advantage of this treatment in enabling the edge to be clearly visible is evident.

Three Pictures illustrating the importance of Contrast in Dock Lighting.

(Reproduced from Illumination Research Technical Paper No. 14 by permission of the Controller of H.M. Stationery Office.)

least important. The cost of maintenance and loss of power due to low efficiency in the case of a poor fitting outweigh first cost. Indirect or semi-indirect fittings are confined to interior work with white ceilings. They have no advantages over direct fittings of suitable type except on the score of reduction of glare and increased cheerfulness. An indirect system may offer some inducement to the eye to wander from the work in hand. The photometric efficiency of a fitting is clearly a measure of economy in power consumption other things being equal. It is well, however, when considering the efficiency of a fitting to remember that light emitted in directions above the horizontal may be comparatively ineffective in many cases, so that a high efficiency from the photometric point of view may mean little in actual practice. Cost of maintenance, including cleaning, will influence the choice of fittings. For dusty locations fittings which are either entirely closed or completely open are preferable. Such fittings as the standard industrial are very easy to keep clean. On the other hand, enclosed fittings may be a necessity where the lamps themselves are specially liable to damage or removal.

Finally, it should be remembered that a carefully designed lighting system may repay the care expended on the design and the cost of the most suitable fittings in several ways. Not least important among these are economy in power consumption and the influence of a cheerful aspect upon the worker.

The value of whitening various objects and sites will now be briefly dealt with. Taking first the case of interiors such as warehouses, whitewashing is accompanied by a reduction in glare due to the bright background behind the light sources, coupled with a cheerful appearance. There is in addition an improvement in illumination dependent on the shape and size of the room and also upon the amount of light reaching the walls and ceiling directly from the lighting units. This improvement, measured as an increase in illumination on the working plane, maybe as much as 20 per cent., and is seldom less than about 10 per cent. in the case of a dock warehouse where walls and ceiling rapidly accumulate dirt.

The fact that depreciation is more rapid for a whitened interior than for one whose walls are of a darker shade is sometimes used as an argument against whitening, since it seems to imply that re-decoration must be more frequent. The fallacy of this argument is seen when it is remembered that of two walls painted white and some other shade respectively at the same time, the wall which was originally white will always be lighter than the other, given similar treatment, at any time subsequently. Thus for a given power expenditure a whitened shed is always an improvement over an unwhitened one, given equal periods between re-decoration.

Proceeding to the whitening of outdoor sites and objects such as coping stones of quays and entrances, control levers and the like, we are here dealing with a different principle, namely, the increase in visibility which results from an increase in tonal contrast. If an object shows no contrast in brightness with its surroundings, and no variations in brightness over its own surface, it will remain absolutely invisible. The well-known experiment in which a glass stopper placed inside a sphere coated on the inside with luminous paint is observed through a small hole in the sphere illustrates this point. The stopper (or other glass object in the sphere) will only be visible with difficulty. The practical application of this principle lies in the fact that if whitening is resorted to it should be used not indiscriminately, but with the definite object of producing violent conrasts. For instance, a whitened bollard on a whitened stone pavement would be only a little more obvious than an unwhitened one on an ordinary dark pavement. If, however, the pavement be whitened and the bollard left dark, the obstacle is immediately thrown into relief even in a comparatively dim light. Similarly, where an object projects upward far enough for its background to change through change in perspective as the observer changes his position, the use of alternate black and white rings ensures that the object itself shall provide the necessary contrast step, apart from the state of the background. Narrow obstacles such as control levers and fencing posts form suitable objects for this treatment.

In the case of coping stones on quays, a whitened strip a foot or so wide provides sufficient contrast with the water beyond, and will serve to show the position of mooring ropes. The most suitable whitening agent for these sites is probably a wash of white cement such as Snowcrete.

ILLUMINATION-VALUES.

To close this review of dock lighting and its problems some mention of actual illumination values obtained and recommended will not be out of place. Road approaches can be dealt with on the lines of ordinary street lighting, and were not specially dealt with in the recent investigations. Measurements of the illumination on railway grids indicate that an average of 0.08 foot-candle on the ground plane is quite common. The minimum in the system may drop to 0.04 or thereabout. These figures are below the values generally recommended. Examination of several published lists of recommended values leads to values of about 0.3 and 0.1 foot-candle for the lower limits of mean illumination and worst spot respectively, for railway grids. Measurements on dock entrance sites ranged between about 1.5 and 0.02 foot-candles as extreme values. The maximum value observed at the water's edge was under 1 foot-candle, and the average value was generally well under a quarter of a foot-candle. Moreover, considerable areas near the minimum of 0.02 foot-candle were met with. Taking the dark nature of stonework and obstructions into account it seems reasonable to recommend a mean value of not less than about 0.3 foot-candle, with a lowest reading at the worst spot at the water's edge of not less than 0.1 foot-candle. An analysis of warehouse lighting based on some thirty warehouses widely distributed as regards location and purpose, shows on the average a maximum illumination on the working plane of 1.25 foot-candles, minimum of 0.14, and overall average of 0.47 foot-candle. These values would be commendable if it were not for the fact that among the measurements on which the averages were based there were a number of readings much below the average. Such cases require improvement in actual illumination level and, in some cases, in distribution also.

Values of quay illumination, other than for entrances, varied very considerably. It is difficult to draw conclusions from them since undoubtedly many cases of quay lighting come under the heading of beacon or pilot lighting.

It is clear that where the use of quays for pedestrians is recognised, the illumination should be at least as high as for dock entrance locks. In the case of narrow quays it should be distinctly higher. Further reference to some of the latest recommendations for artificial lighting installations will be found in the ILLUMINATING ENGINEER, September, 1930, page 217.

In concluding this review of a particular section of artificial lighting, covering a large range of theoretical and practical problems, it is well to draw attention to a principle which constantly asserts itself, but does not perhaps receive sufficient recognition. It is that "seeing power" is fundamentally a function simply of the apparent contrast in the objects seen. This apparent contrast is influenced by actual differences of reflectivity and by the presence of glaring sources of light in the field of view as well as by the actual value of illumination. Too much emphasis should not, therefore, be laid upon illumination values alone.

Artificial lighting has a physiological and psychological aspect as well as a scientific and technical. The ultimate criterion of the success of the scientific and technical treatment will always be the satisfaction of the requirements of the human being for the business in hand. A subject such as dock lighting, associated with questions of safety and working efficiency, is thus eminently suitable as a happy hunting ground for those engaged in the wider development of a science so closely related to human activities.

DISCUSSION

Mr. C. W. SULLY (*President*), in opening the discussion, congratulated the author on the able way in which he had summarised his data and enabled conclusions of general interest and wide application to be drawn. Mr. Preston had been responsible for a report on this subject recently issued by the Department of Scientific and Industrial Research,* which furnished a good illustration of the humanitarian value of the work being done by the D.S.I.R. in relation to lighting.

Mr. H. TAPLIN (Mersey Docks and Harbour Board) drew attention to the importance of shadows. Thus, when a light was fitted to a jib, the shadow of the load thrown by a beam directed vertically downwards might possibly be mistaken by a person standing on the quay for the shadow cast by some stationary and familiar object—with unfortunate consequences. He was not aware of any accidents attributed to poor lighting having occurred on the Mersey Docks and Harbour Board, so that the lighting might be considered adequate. A distinction should be drawn between the financing of improved street lighting and improved dock lighting. If the cost of the latter occasioned an increase in charges to shippers this would naturally operate as a drawback.

Mr. R. E. ROGERS (Liverpool) congratulated the author on the simple manner in which his valuable data had been presented. In his view great importance should be attached to uniformity of illumination—a condition characteristic of daylight. He was rather opposed to the fixing of reflectors below gas lamps as these were apt to accentuate glare and also acted as an obstruction to cleaning.

Mr. H. MIDGELEY (Liverpool) commented upon the similarity between problems met with in dock lighting and in street lighting. He would like to know whether any device with marked advantages in regard to fog-penetration had yet been devised.

Mr. T. E. RITCHIE (London) expressed his appreciation of the paper, though there were a few points on which he was at variance with the author. He remarked that the fundamental requirement of dock lighting was that ships should enter the dock with complete safety and illustrated this point by the aid of several lantern slides. He also exhibited a special form of fitting designed by officers of the Port of London Authority. Mr. Ritchie contended that an installation furnishing a mean illumination of one foot-candle on the working plane should not be considered exemplary. An installation shown in one of his slides receiving *twice* this illumination had been shown—and he did not think that this was regarded by users of the dock as extravagant.

Mr. JAMES SELLARS (Manchester) said that he personally found some difficulty in a complete separation of "disability glare" and "discomfort glare," and would like to know how this was effected.

Mr. J. S. Dow (London) emphasised the extreme importance of contrast, to which Mr. Preston had referred. There seemed scope for such devices as the whitewashing of edges of quays and the areas adjacent to bollards and other projecting objects on a much larger scale. In regard to the intensity of illumination furnished in warehouses he recalled that in one of the sheds at the new Southampton Docks, which the Society had recently visited, 4½ foot-candles was provided.

Mr. J. S. PRESTON, in reply, said he would mention categorically the various points raised in the discussion for the sake of brevity.

Mr. Taplin's criticism of the use of projectors at the extremity of a crane jib was a valuable one. The possibility of a quay worker finding himself immediately below the load, in its shadow, and so being unaware of its proximity, was also a matter for consideration. As regards the financial side of better lighting, it was to be hoped that improvement in efficiency of working due to better lighting would offset the increased expenditure, so avoiding increased charges to shippers.

Mr. Rogers' emphasis on uniformity of illumination was sound where sufficient diffusion could be assured (as with daylight). Unfortunately, only in the most favourable interior systems could this ideal be realised. Elsewhere the attainment of uniform artificial illumination may often entail the use of glaring light sources.

Mr. Midgeley had raised a vexed question in the matter of fog penetration. It was a fact that as better penetration was obtained by using redder light, so the luminosity of the light diminished, eventually becoming zero for infra-red, which gave the best penetration. Thus the use of red light for this purpose was attended by greatly increased power consumption in order to obtain the required intensity of light. Moreover, the improvement over the use of white light secured in this way was so small as to be of doubtful practical value.

Mr. Ritchie's lantern slides were most useful in showing the results which could be obtained, given the best facilities and conditions. Such was not commonly the case, however, and at the present moment an illumination as low as one foot-candle on dock entrances could be considered exemplary, having regard to the average existing state of affairs.

In reply to Mr. Sellars, Mr. Preston pointed out that actually discomfort glare always accompanied disability glare, so that separation could not in fact be realised, but suitable choice of experimental conditions enabled the quantitative effect of the latter to be found irrespective of the discomfort which accompanied it.

The remarks of Mr. Dow and other speakers concerning the importance of contrast were gratifying. While higher general levels of illumination were frequently most desirable, the exploration of other methods of increasing contrast was a valuable means to the improvement of existing lighting systems with the minimum of financial expenditure.

Cordial votes of thanks to Mr. Preston for his paper, to Mr. P. J. Robinson (Liverpool City Electrical Engineer) for presiding, to the Liverpool Corporation Electricity Committee for their hospitality, and to the Mersey Docks and Harbour Board for according facilities for the visit to the docks earlier in the day, terminated the proceedings.

* Tech. Paper No. 14. Part I. Docks, Warehouses and Their Approaches, by J. S. Preston, M.A. (H.M. Stationery Office, 9d. net.)

The Fixed Light Equivalent of Flashing Lights

By W. M. Hampton, Ph.D., B.Sc. (Lond.), F.Inst.P.

(Research Dept., Chance Brothers and Co., Ltd., Glass Works, Smethwick.)

IN THE ILLUMINATING ENGINEER for December, 1933, Toulmin-Smith and Green published a very valuable summary of experimental work carried out by them on the fixed light equivalent of flashing lights at conspicuities above the limit of visibility. It has been known for a long time that the Blondel-Rey formula only deals with conditions at the limit of visibility, and that these conditions are not necessarily the most important in either marine or aerial lighting practice. It is not the purpose of the present note to criticise the experimental work carried out, but to suggest a more general type of formula which will express the results obtained.

It is difficult to justify the type of expression shown in equations (1) and (2) of the paper quoted above, since it would seem essential that the apparent intensity of a flashing light of a long duration of flash should become equal to that of a fixed light, whereas both formulas suggested indicate that the flashing light has a higher apparent intensity than the fixed light, when the duration of flash becomes considerable. The question was therefore investigated of representing the results obtained by a formula of the general type.

$$\frac{I_o}{I} = \frac{t}{a + t} \quad \text{.....(1)}$$

where " a " is a constant, obviously not the same as the Blondel-Rey constant, but which, it was hoped, would be found to be simply a function of E_c. From the curves given in Fig. 5 of the paper under review, the value of I_o/I was read for different values of E_c and the value of " a " in equation (1) calculated. The results are given below:—

$\frac{E_c}{\text{candles/mile}^2}$	Values of "a" for a duration of flash of:		
	0.1	0.2	0.3 seconds.
0.2	0.176	0.192	0.200
0.5	0.085	0.089	0.084
1.0	0.054	0.050	0.046
2.0	0.034	0.032	0.025
4.0	0.018	0.019	0.013

It is seen that the values given by this calculation are reasonably constant for a given value of the conspicuity over a considerable variation in the duration of the flash.

Fig. 1 shows the logarithms of E_c plotted against the logarithms of " a," and these points lie reasonably on a straight line. The equation of this straight line indicates that the relation between E_c and " a " is

$$E_c a^{1.235} = 0.0255 \quad \text{.....(2)}$$

and substitution from this in equation (1) leads to the expression

$$\frac{I_o}{I} = \frac{t}{\left(\frac{0.0255}{E_c}\right)^{.81} + t} \quad \text{.....(3)}$$

If the assumptions made are correct this expression should now apply generally to all the experimental results obtained by Toulmin-Smith and Green.

Fig. 2 gives a comparison of the results given by equation (3) above those given by Toulmin-Smith and Green's equation (1) and the experimental results from

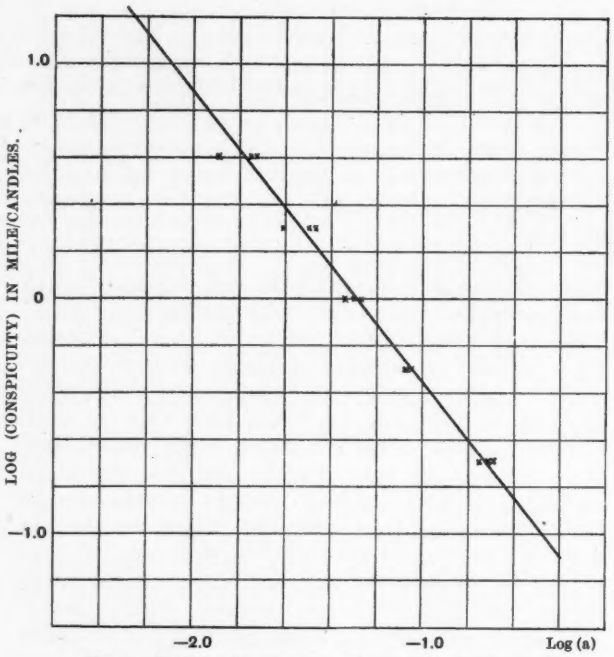


Fig. 1.—Relation between the value of (a) and Conspicuity.

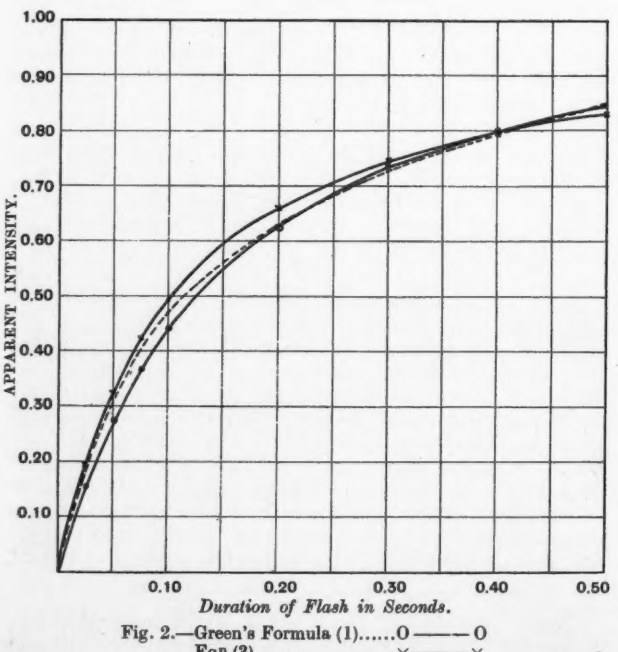


Fig. 2.—Green's Formula (1).....O——O
Eqn (3) .....×——×
Experimental ..... - - - -

the latter authors' Fig. 6 for the case when $E_c = 0.425$ candles/mile^2. It is seen that the simplified expression suggested in equation (3) represents the experimental results as accurately as the equation given by Toulmin-Smith and Green, and it is clear that the revised expression is not subject to the same theoretical objection as that formerly suggested.

When the inevitable experimental error of the determinations, as indicated in Toulmin-Smith and Green's Fig. 4 is considered, it will be realised that the differences between the experimental results and the curves given by these two expressions are negligible.

Fig. 3 shows a family of curves derived from equation (3) above, for the range of conspicuities covered by the experimental work of Toulmin-Smith and Green, and it is suggested that the agreement between these curves and the experimental curves is well within the limits of experimental error of the determination.

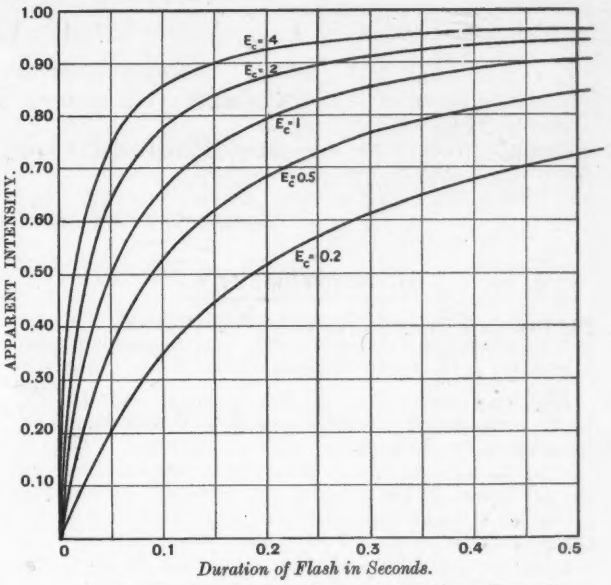


Fig. 3.—Fixed Light Equivalents calculated from Equn (3)

SUMMARY:

A general equation of the type $\frac{I_o}{I} = \frac{t}{a + t}$ has been developed, which takes account of variations in the level of conspicuity, and which agrees, within the limits of experimental error, with the determinations published previously by Toulmin-Smith and Green. This expression is not subject to the theoretical objections which are indicated as operating against the previous expression put forward by Van Vloten and by Toulmin-Smith and Green. The value of the constant determined from this expression when $E_c = 0.425$, is 0.100, which, it is suggested, could be accepted as a standard for finding the fixed light equivalent, and hence the range of flashing lights.

Association of Public Lighting Engineers

32, Victoria Street, London, S.W.1

Proposed Easter Visit to Paris, Brussels, Antwerp and Ostend.

A feature of great interest at the last Conference of this Association held in Margate in September last was the paper read by Mr. J. W. Partridge, Engineer-in-Chief in Charge of the Street Lighting of Paris, on the lighting of that City, which presented many points of practice differing from those usual in this country.

A desire has therefore been expressed that members might have an opportunity of visiting Paris and examining the lighting, and an official inspection has accordingly been arranged to take place next Easter, during the period **March 29 to April 2, 1934.**

There is no doubt that the visit will be of great interest from a technical standpoint.

Arrangements have been made with Messrs. Cook and Sons, who are prepared to undertake the complete organisation of the tour, the inclusive cost of which (including meals, first class hotels and all travelling expenses) is **£14 10s. per person.**

Members of all classes are free to take part in this visit and they may be accompanied by Chairmen of Committees and others associated with the Local Authority which they represent; but as this is regarded purely as a business tour it is not proposed that ladies should be included in the party.

In the meantime members are asked to inform the Hon. Secretary (preferably by the end of February) whether they desire to take part in the tour so that instructions may be given for the necessary booking forms to be forwarded by Messrs. Thos. Cook and Son, Ltd., who will attend to the details of the journey and the eventual collection of expenditure.

Annual Meeting and Conference Aberdeen, September 17-20.

Notices of the forthcoming Annual Meeting and Conference, which is to be held this year in Aberdeen, will be issued shortly.

In the meantime we take the opportunity of announcing the date, September 17-20, so that members may arrange their engagements accordingly. It will be observed that the date is somewhat later than usual —an inevitable consequence of the fact that the British Association is meeting in Aberdeen during the first week of September.

We have no doubt that this Conference (the " furthest north " of all conferences so far held) will prove an exceedingly interesting and enjoyable one. Members may feel assured that the public lighting engineer of the city, Mr. Alexander Forbes, will do everything possible to make it so.

The programme of papers and events is now being arranged, but before this is concluded may we urge members to come forward with offers and suggestions? The Association ought now to aim at attaining the position of having a good store of papers, long before the Conference opens and it is the obvious duty of members to help in this respect and not to leave the matter entirely to the officers—as has sometimes happened in past years.

May we also, even at this early stage, remind members of their obligation to commence the collection of data on public lighting in their respective areas for inclusion in the annual report?

Literature on Lighting*

(Abstracts of recent articles on Illumination and Photometry in the Technical Press)

(*Continued from page 17, January, 1934*)

II.—PHOTOMETRY.

21. Primary Standard of Light. G. Ribaud.

Rev. d'Optique, 12, *No.* 8, *pp.* 289-301, *August*, 1933.

Describes researches on the primary standard of light proposed by the Bureau of Standard. (See Abstract 190, November, 1931.) A high frequency induction furnace of the spark type was used to melt the platinum in the crucible. During any given melt or freeze the extreme values of the brightness rarely differed by more than 1 per cent. The final value for the brightness of the radiation is given as 58.78 candles per cm.^{2}. The author concludes that this type of black-body standard of light is readily reproducible. Some improvement in detail is suggested, and, in particular, a modification, which would eliminate the uncertainty introduced by the absorption of the totally reflecting prism.

L. J. C.

22. Primary Standard of Light. (Part II.)

J. W. T. Walsh, *World Power*, 21, *pp.* 19-21, *January*, 1934.

The author presents results of tests of the brightness of a black body as a primary standard of light, and describes the apparatus used at the Bureau of Standards. (For Part I., see Abstract 233, of September, 1933.)

C. A. M.

23. The Heterochromatic Photometry of Tungsten Lamps. G. Ribaud.

Rev. d'Optique, 12, *No.* 5, *pp.* 194-200, *May*, 1933.

The measurement of the candle-power of tungsten lamps operated at a high colour temperature introduces serious difficulties owing to the fact that the usual carbon filament standards of candle-power have a very low colour temperature. It is shown that standards of known candle-power and possessing a high colour temperature can be established by the use of a tungsten lamp, which can be operated on the one hand at a high efficiency and, on the other hand, at such a voltage that its colour temperature approximates to that of the carbon standards. The ratio of the candle powers of the lamp at the two efficiencies can be determined with precision by the measurement of the ratio of the spectral intensities of the lamp, for a convenient wave-length (Crova wave-length), a precise knowledge of the colour temperature of the lamp when operated at a low voltage is unnecessary. The author shows that with such a lamp the transmission factors of blue filters used in heterochromatic photometry can be determined directly by photometric extra-polation.

L. J. C.

24. A New Microphotometer. J. Weigle.

Rev. Sc. Inst., *Vol.* 4, *No.* 11, *pp.* 595-597, *November*, 1933.

The author has taken advantage of modern methods of amplifying photoelectric currents and has built a compact and efficient instrument. A photograph and a complete description of the apparatus are given.

F. J. C. B.

25. Recent Applications of Photoelectric Cells. R. C. Walker.

World Power, 21, *pp.* 11-19, *January*, 1934.

Summarises recent applications of photoelectric cells, including the use of the rectifier type in connection with illumination-meters.

C. A. M.

26. A Light Beam of Uniform Intensity of Cross Section. J. Tracy and I. Clyde Cornig.

Rev. Sci. Inst., *Vol.* 4, *No.* 11, *pp.* 600-602, *November*, 1933.

The article deals with a photoelectric method of measuring the intensity of a beam of light at any point of its cross-sectional area. The application of this method led to the production of a light beam, the intensity of which over an area, 30 cm. x 30 cm., varied by less than one-third per cent.

F. J. C. B.

III.—SOURCES OF LIGHT.

27. Colour Distortion with Illumination by Gas-discharge Lamps. H. Bertling.

Licht u. Lampe, 22, *No.* 24, *p.* 608; *No.* 25, *p.* 636, *No.* 26, *p.* 657, 1933.

In the first section the author gives data of the colour distortion with Hg, Na, and Ne light for the four colours ultramarine, chrome green, chrome yellow, and vermillion. He gives the position of these colours in the colour triangle for each type of discharge lamp in comparison with black body radiation at T=5000° abs. In the second section the author considers the change in colour brightness with illumination by Hg, Na and Ne lamps. In the third section the colour distortion of light from high-pressure cadmium lamps, low-pressure cadmium lamps, zinc, magnesium, and thallium lamps is dealt with in the same manner.

E. S. B.-S.

28. A Sunlight Vapour Lamp. Anon.

El. World, 102, *pp.* 742-743, *December* 9, 1933.

It is stated that, by adding a small amount of rubidium to the filling of a mercury vapour discharge lamp, sufficient red radiation is obtained to produce light of a colour approximating to sunlight.

W. C. M. W.

IV.—LIGHTING EQUIPMENT.

29. Electric Lighting for Small Stages. V. Praetow.

Licht u. Lampe, 22, *No.* 25, *p.* 633, 1933.

Lighting from the footlights, proscenium, back-stage doors and soffits and horizontal and vertical illumina-

* Abstracts are classified under the following headings: I, Radiation and General Physics; II, Photometry; III, Sources of Light; IV, Lighting Equipment; V, Applications of Light; VI, Miscellaneous. The following, whose initials appear under the items for which they were responsible, have already assisted in the compilation of abstracts: Miss E. S. Barclay-Smith, Mr. W. Barnett, Mr. S. S. Beggs, Mr. F. J. C. Brookes, Mr. H. Buckley, Mr. L. J. Collier, Mr. H. M. Cotterill, Mr. J. S. Dow, Mr. J. Eck, Dr. S. English, Dr. T. H. Harrison, Mr. C. A. Morton, Mr. G. S. Robinson, Mr. W. R. Stevens, Mr. J. M. Waldram, Mr. W. C. M. Whittle, and Mr. G. H. Wilson. Abstracts cover the month preceding the date of publication. When desired by readers we will gladly endeavour to obtain copies of journals containing any articles abstracted and will supply them at cost.—Ed.

tion are considered, and suggestions made of the best fittings and lamp wattages to be used.

E. S. B.-S.

30. Skylights Controlled for Uniform Illumination. Anon.

Electromics, 6, *p.* 334. *December*, 1933.

A note of a system for obtaining uniform intensity of light throughout the day, adopted in the mail-sorting room of an American post office. Photo-electric cells operate electric motors driving a system of louvres and shutters controlling the illumination on the working plane.

S. S. B.

31. Daylight Effect produced with New Lighting Unit. R. M. Maxwell.

El. World, 102, *pp.* 828-829. *December* 23, 1933.

A show window installation utilising special combination " daylight " lighting units is described. The units consist of trough reflectors of mirror glass containing 150-watt gas-filled filament lamps and blue hot-cathode discharge tubes. Using 200 watts of lighting per foot run of window, an illumination of 200 foot-candles is obtained.

W. C. M. W.

V.—APPLICATIONS OF LIGHT.

32. A Century of Progress. C. M. Cutler.

Light, 3, *pp.* 5-36. *November*, 1933.

A collection of photographs of exhibition lighting at the Century of Progress Fair at Chicago is given. In many cases detailed diagrams are given indicating the method of producing the various architectural features.

C. A. M.

33. Electric Lighting in Schools. Anon.

El. Times, 84, *p.* 815, *December* 21, 1933.

Gives three photographs, with a brief description, of schoolrooms. The lighting in all these cases is by means of opal diffusing bowls, and the results are said to be excellent. A fourth photograph shows a classroom lit by means of reflector units.

W. R. S.

34. Lighting on British Railways. Anon.

World Power, 21, *p.* 28, *January*, 1934.

A group of photographs is given showing present-day practice in lighting on both main line and Underground railways.

C. A. M.

35. Street Lighting. Anon.

Elect., 112, *p.* 34, *January* 12, 1934.

Particulars, with a photograph, are given of street lighting experiments conducted on the Paris-Versailles road. Lamps employed: the twin filament gas-filled type. Sodium vapour lamps are also being used for the first time in France.

C. A. M.

36. Street Lighting. Anon.

Elect., 112, *p.* 51, *January* 12, 1934.

A new street lighting installation at Clacton is illustrated and described. 300-watt refractor lanterns are employed, and a visibility of 600-700 yards is claimed.

C. A. M.

37. Finsbury's Improved Lighting. Anon.

El. Times, 84, *p.* 801, *December* 21, 1934.

Four photographs are given comparing the new electric street lighting at Finsbury, with the gas lighting which it has replaced. The fittings are asymmetric refractor units mounted at 21 feet and suspended over the carriage way. The spacing varies from 5:1 to 6:1.

W. R. S.

38. Edinburgh Festival Lighting. Anon.

El. Times, 84, *p.* 831, *December* 28, 1934.

Three photographs and a brief description of the floodlighting at Edinburgh for the Christmas and New Year holidays are presented.

W. R. S.

39. Floodlighting of Notre Dame. Anon.

El. Times, 84, *p.* 799, *December* 21, 1934.

Gives two photographs of Notre Dame de Paris, which has recently been floodlighted by electricity.

W. R. S.

Building Research*

Some Problems in Lighting and Heating

THE report of the Building Research Board for the past year summarises a very considerable amount of work, much of which deals with building materials, their strength and the effect on them of weathering. Numerous special researches are also recorded, of which those concerned with daylight illumination are of special interest.

A method of predetermining daylight factors by the aid of a pinhole camera is explained. The camera may advantageously take the form of a cylinder with a pinhole pierced horizontally at the required height centrally in one of the plane ends. With the pierced end placed horizontally at the required height windows in all four walls of a room (and even skylights, provided they are not situated vertically above the camera) can be photographed with a single exposure on a sheet of sensitive paper lying round the cylindrical side of the camera. By superimposing on the photograph a suitable grid, the contribution of any particular window to the total daylight factor at the point where the photograph was taken can be obtained. A similar method can be applied to examination of periods of insolation (i.e., access of direct sunlight) by superimposing on the photographs an auxiliary transparency showing the projected sunpaths for various seasons of the year.

Reference is also made to certain experiments with glass and glazing. Specimens of ultra-violet transmissive glass exposed for two years have apparently undergone no change since the previous examination, the transmissibility of the glass having reached its lowest point in the first five months of exposure to sunshine. Plate-glass toughened by a special heat-treatment was also studied. Favourable results have attended tests of impact-resistance and of the power of withstanding sudden temperature changes. The fact that the sheets, when broken, shatter into approximately cubic fragments appears an advantage, since sharp and possible dangerous splinters are less liable to be formed.

Other informative experiments deal with heating. Continuous heating of buildings, even when they are not in use every day, has occasionally been advocated. An experiment contrasting the cost of maintaining a temperature of 65 continuously, and from 9.30 a.m. to 5.30 p.m., is, therefore, of interest. This experiment showed that the intermittent daily heating required three-quarters of the expenditure of thermal energy for continuous heating. Other researches on heat transmission indicated the economies to be derived from double-glazing for roof-glass. The reflection coefficients of various materials for solar radiation have also been studied.

* Department of Scientific and Industrial Research: Report of the Building Research Board for the Year 1932. Published by His Majesty's Stationery Office. 2s. 6d. net.

Recent Patents

Spec.: No. 402,149, Improvements in or Relating to Lampshade.

This invention is for improvements in or relating to lampshades or like fittings, and has for one of its objects to provide a lampshade composed of a frame and glass or other panels, wherein the frame itself is practically entirely concealed in the assembled shade. Another object is to provide a simplified form of such frame.

Spec.: No. 402,348, Improvements in Gas Mantles.

A double gas mantle can be made with the aid of suitable tubular fabric impregnated with the materials required for forming the skeleton, such as thorium and cerium nitrates, by tying a suitable length of the tubular fabric with thread at about its middle point, and then drawing one half of the tube inside out, over the other half, so as to make a double-walled tube, substantially closed at one end. The mantle is then finished off in the usual manner. Such mantle, when properly constructed, should consist of inner and outer skeletons, which are in close contact over the whole of their adjoining surfaces, and in effect form a mantle of double thickness.

Spec.: No. 402,696, Improvements in or Relating to Gas-filled Electric Incandescent Lamps.

It is known that for some classes of work sources of ultra-violet radiation, which emit relatively more longer waves and fewer short wave ultra-violet, are more to be desired than mercury vapour arc lamps. For such purposes it has been proposed to use gas-filled lamps. The invention here described makes it possible to reduce very greatly the volatilisation of the incandescent filament. Experiment has shown that by using a filling gas the molecular weight of which amounts to at least one-third of that of the metal which constitutes the incandescent filament the volatilisation of the latter is so very greatly reduced, and therefore the permissible filament temperature is increased to such an extent that a very great increase in the amount of energy radiated in the ultra-violet range of the spectrum can be obtained.

Spec.: No. 402,665, Improvements in Luminous Electric Discharge Tubes.

Electric discharge tubes of the type adapted to form letters or other symbols of an advertising sign are the subject-matter of this invention, and according to the inventor are called "lamps." The object of the patent is to reduce the difficulty of concealing the subsidiary parts of the lamp, and thus to make possible the use of tubes of larger diameter in comparison with the height of the sign.

Spec.: No. 402,664, Improvements in or Relating to Incandescent Electric Lamps.

It has already been proposed to construct electric lamps in which the filament is mounted on a support of insulating material fitted within the interior of the glass envelope. The object of this invention is to make use of this method of mounting the filament so as to produce tubular lamps for luminous designs, such as letters, characterised by great simplicity of construction and allowing for the use of tubes of great length, of small diameter, and of the most varied forms.

Spec.: No. 402,648, Improvements in and Relating to Lighting Fixtures.

The invention has for its objects the improvement in lighting fixtures of the kind wherein the light rays pass through a transparent or translucent medium such as glass, and which are particularly adapted for decorative lighting by individual lamps or strip or panel lights. One other object is to provide a diffused lighting over the entire surface area, so that the exact source of light is not clearly defined.

Spec.: No. 402,610, Improvements in and Relating to Electric Battery Lamps.

The battery lamp, according to this invention, is in that an umbrella-shaped reflector is arranged upon the movable arm, and the central axis of the reflector and incandescent bulb are normal or nearly normal to the movable arm. It is claimed that by this means the light obtained is more suitable for general purposes. It also allows the beam of light to be adjusted, both when the lamp is standing, and when it is hanging, more or less normal to a horizontal plane.

Spec.: No. 402,703, Improvements in or Relating to Electric Discharge Device.

The apparatus described consists of a water-cooled anode, a glass tube or sleeve sealed thereto, and other parts. In order to maintain the anode cool, there is provided a jacket which surrounds the electrode and which is detachable, secured to the latter by means of a flange and clamping arrangement

Spec.: No. 402,869, Improvements in or Relating to Electric Incandescent Lamps.

The invention describes a type of incandescent lamp which is cheap, simple in construction, and which is particularly adapted for use as an anti-dazzle lamp, and as a fog penetrating lamp. The lamp is intended for use on vehicles of all kinds.

Spec.: No. 402,862, Improvements in or Relating to Miners' Safety Lamps.

The object of this invention is to provide improved means for protecting the mantle from damage in miners' safety lamps of the type in which the fuel is vapourised to heat the mantle to incandescence. The mantle comprises a number of bars extending from the base to the top of the mantle. Preferably the bars pass over the top of the mantle for which purpose they may be of an inverted U-shape.

Spec.: No. 402,816, Improvements in Illuminated Signs.

By the employment of transparent material, such as glass or celluloid, or a combination with other materials, we provide a space to hold Neon Gas or any other gas with similar qualities to be lit by an electric current from a magneto or from any form of coil ignition having a sufficiently high voltage. It is claimed that in the case of installations on buildings the cost is very much lowered, while such signs could easily be used on any type of motor vehicles. D. K.

Modern Developments in Street Lighting*

By J. M. WALDRAM, B.Sc., A.C.G.I., F.Inst.P.
(Of the Research Laboratories of The General Electric Company, Limited)

THE PROBLEMS OF STREET LIGHTING.

THE general problem of street lighting has often been stated and will probably be familiar; nevertheless it must be briefly mentioned before new developments can be discussed. Not everyone, perhaps, recognises how difficult a problem it is. Street lighting is in many ways unique among the tasks undertaken by the illuminating engineer. Nowhere else does he meet quite so awkward a set of indeterminate factors, or quite so exacting requirements; and so little money with which to fulfil them.

This is a very real problem, which needs immediate solution. It is an anomaly that a national trunk road should be built, drained and maintained nationally, and the lighting left to local authorities, each lighting its section according to its own ideas and the length of its purse.

Then there is the matter of cleaning and maintenance. The magnitude of this task can be gauged from the fact that the headquarters of the Lighting Department of the City of Sheffield were built at a cost of £15,500 and that the Department employs 144 men.

On the technical side there is also a host of problems. The very shape of area to be illuminated is unusual—a long and narrow strip, generally neither straight nor flat. On either side are the two narrower strips of the footways, and beyond them again, in most instances, the fronts of buildings. This area the engineer must so light that all the various users of the highway may be able to see as they go about their particular business. His aim, above everything else, must be "accident-proof lighting." The householder must see safely the way to his door, and the policeman must be able to see to protect him.

There are, therefore, in addition to financial and maintenance questions, such technical problems as the height and location of light sources; distribution of intensity and of illumination and the amount of illumination necessary; problems of photometry (which in street lighting is a study in itself, particularly when large differences of colour are involved such as occur with discharge lamps) and the more nebulous problems of visibility, glare, appearance of the street, shadows and elusive dark patches—problems which are very difficult to solve quantitatively, yet which are right at the heart of street lighting.

THE DIRECTION OF RECENT DEVELOPMENT.

One of the most important influences on street lighting during the past few years has undoubtedly been the issue of the British Standard Specification for Street Lighting, No. 307, first issued in 1927 and revised in 1931. To attempt the preparation of a Standard Specification on a subject where so much fundamental investigation remains to be done is courageous, and has not been attempted abroad except on very general lines. Nevertheless, it has been of greater value to street lighting in this country than any other influence. Although the subject is still little understood, the very discussion of its uncertainties at a common table by those most intimately concerned with all its aspects has been an incentive to study of the problem, and brought a realisation of its essentials and of the gaps in our knowledge, which could hardly have come about otherwise.

Another development of the last few years has been the appointment in an increasing number of important towns of a lighting engineer, with public lighting as his sole duty. Such an appointment should be independent: it is not satisfactory if the public lighting engineer is under control of, say, the city electrical engineer or the manager of the corporation gas works. The Sheffield Corporation Lighting Department under Mr. J. F. Colquhoun, which has already been mentioned, is one of the most completely equipped and efficient departments in the country. Similar organisation is to be found at Glasgow, Leicester, Bournemouth, Paris, and the City of London. Public street lighting can only progress upon a sound basis as proper municipal machinery of this sort is provided. It is interesting to note also that one of the great gas companies has recently supplied all its various lighting inspectors with portable photometers, with a view to improving the supervision of street lighting.

IMPROVEMENTS IN EFFECTIVENESS.

Modern developments in efficient equipment have been largely due to two factors—the Standard Specification and the new light sources. But side by side with the development of efficient gear has been the study of the most effective manner of using it. Here we enter upon the more nebulous side of the problem where the slide rule and photometer must needs be discarded for the empirical and qualitative methods of personal observation and visual appraisal. Some quantitative work is possible, but only when the problem is sufficiently understood for us to know what to measure and how to interpret the results. This increasing attention to good visibility, in addition to values of illumination, is indeed one of the most important recent developments. It was natural that with so many conflicting requirements to be fulfilled, the lighting engineer has hitherto preferred the devil of illumination which he knew to the devil of visibility which nobody knew. Installations were designed to give a known minimum illumination by more or less conventional means, on the assumption that so long as nothing very unorthodox was done, visibility would take care of itself. Gradually, however, a few guiding principles of design for good visibility have become recognised; and emphasis is being placed more upon visibility and less upon illumination.

The mechanism of visibility of objects at night is an extraordinarily complex problem, and in the present

* Abstract of Paper read before the Royal Society of Arts at 8 p.m. on Wednesday, January 17th, Lieut-Colonel Kenelm Edgcumbe, T.D., M.Inst.C.E., M.I.E.E., presiding.

paper it is only possible to outline some of its main components and the work which is being undertaken.

The problem may be conveniently divided into two parts—the ability of the observer to see, which has been termed his " perceptibility "—and the appearance presented to the observer by the object and its background, which has been called its " noticeability."

The first part is a problem of physiological optics, on which several workers have been engaged—in particular, Bordoni in Italy, Holladay in America, and Stiles at the National Physical Laboratory in this country. Dr. Stiles has undertaken a most laborious investigation of glare and its effects and it is mainly to his researches that we owe our present knowledge of the subject.

Glare, with its effects both upon the comfort of the observer and on his ability to see, is in itself a most complex problem, only certain aspects of which are amenable to quantitative experiment; and its very complexity has, so far, prevented a workable application to the street-lighting problem, although it is to be hoped that a solution may be forthcoming. At the same time it is one of the most important factors in design, limiting the distribution, intensity, location and mounting height of sources. At present we have to be content with empirical rules based on experiment —often the costly one of producing an expensive refractor or fitting which is found unsatisfactory in practice.

The new discharge sources have brought with them other problems. In some the light emitted is monochromatic, and claims are being made for improved visibility consequent on greater visual acuity. Probably the visual acuity can be shown to be improved, but whether an improvement results in visibility of objects in the street is doubtful and awaits confirmation. Curiously, the blue-white light of the discharge lamps employing mercury gives a strangely clear-cut effect, similar to that obtained with the old magnetic arc, which has so far defied analysis.

The second half of the problem is less complex. It has been shown that in the great majority of instances in street-lighting conditions objects are seen on a road by silhouette against a brighter background. Only in special circumstances is it possible for the object to be brighter than the background, and no reliance can be placed upon visibility by such methods. Evidently, therefore, it is of advantage to make the background as bright as possible, the aim being to produce a uniform backgrcund of high brightness, against which anything can be seen, and free from dark patches in which objects can be hidden. If this can be accomplished in all weathers the problem of street lighting is solved so far as visibility is concerned.

It would be impossible in the compass of a short paper to go deeply into the problems of road-surface brightness, but some of its peculiarities can be noted. First of all, the road does not look in the least as it might be expected to look, from a consideration of the distribution of illumination upon it. The surfaces of roads have properties intermediate between a matt surface and a mirror, and as they become more polished so they reflect more and more light in the same plane as the incident light and less in other planes. When the surface is observed from ordinary viewpoints, this results in a streak which grows brighter and narrower as the road is more polished.

Naturally, the state of polish is a fugitive thing. Traffic wear, mud, and most of all wet, alter it very considerably, and with it the appearance of the road. As rain begins to fall so the streaks narrow and brighten, and the dark spaces between them become broader and blacker, and become eventually potential hiding-places for cyclists and pedestrians: the well-known dangers of the " wet night " have arrived.

These peculiar characteristics are at once the lighting engineer's opportunity and his responsibility. Rightly used, they may enable him to achieve a very high and moderately uniform brightness of road surface, at least when the road is dry. But good results can only be achieved by careful attention to the position, in the perspective view, of the sources of light. Careful distribution of light by refractors will avail very little to fill up dark spaces on a polished road, if the sources are in the wrong place. Numerous examples are to be found in practice of sources placed on one side of the road only, or omitted at key positions on bends, which bring about a real danger.

EXAMPLES OF NEW DEVELOPMENTS.

The possible lines of development have been outlined, and it remains to describe the practical form which developments have taken.

Reference has already been made to the increased use of the British Standard Specification. This is showing itself in greater mounting heights and spacings, and in more careful location of lamps. The extension pieces used to increase the height of the conventional 11 ft. 6 in. post to 13 ft., the least mounting height recognised by the Specification, are a small example which will be familiar. It is being realised, too, that for a given illumination, more powerful sources, mounted at a greater height and at longer spacings, are not only more effective but considerably cheaper in both initial and maintenance cost than the more usual lower sources at short spacings.

CONCLUSIONS.

The main conclusions reached in this paper may be summarised. Modern developments in street lighting have been described both in general trend and in particular achievement. In general development has been, on the one hand, to greater efficiency, in both the production and in the utilisation of light; and, on the other hand, to greater effectiveness in the study of the components of good visibility. This trend has been helped both by the British Standard Specification and by the recent production of high efficiency electric discharge lamps. The practical results of this trend have been seen in more advantageous location of sources, more efficient gear, and more suitable distributions, and in the development of quite new forms of apparatus.

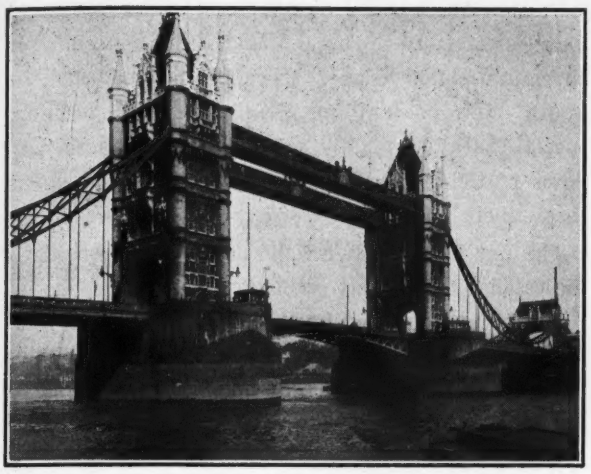
Much time might be spent upon the further intricacies of street lighting, but what has been said may have been sufficient to increase interest in a fascinating subject, and perhaps to arouse some sympathy for the street lighting engineer in his difficult and little-appreciated job.

" Illuminants "

An interesting paper on " Illuminants " was read before the Photomicrographic Society of London recently by Mr. W. E. Watson Baker, A.Inst.P., F.R.M.S.

Mr. Watson Baker dealt in detail with the various forms of lamps available for photomicroscopic work, including gas, oil, and electric lamps. Electric lamps. somewhat naturally, were described in detail, since of latter years their use in this type of work has increased considerably, and various types of special lamps marketed by individual companies were described.

From the discussion which followed the paper, it is clear that the question of illuminants for photomicroscopic work is a long way from being satisfactorily solved, in spite of the considerable research which has been, and continues to be, undertaken in this most interesting subject.



The Lighting of The Tower Bridge, London

TOWER BRIDGE, with its distinctive form, lives in memories all over the globe, for there are very few visitors to London who leave without seeing it. It is the first bridge, from the sea, over the Thames, and forms a portal to the great City of London, which is befitting in its dignity and grandeur.

DESIGNED BY SIR HORACE JONES.

The bridge was designed by the then City Architect, Sir Horace Jones; one of the conditions imposed at the time was that the structure must be in keeping architecturally with the historic Tower of London, which lies adjacent to the northern approach, and from which, of course, the bridge takes its name. The original designs were carried out in a modified form by Sir J. Wolfe Barry, as Sir Horace Jones died in 1887, when the foundations had made little progress. The modifications were important, involving an increase of span and other dimensions, a difference in the high-level bridges and other parts, so that actually Sir J. Wolfe Barry carried the whole thing through from the original sketches.

OPENED IN 1894 BY THE PRINCE OF WALES.

The bridge was opened on June 30, 1894, by the then Prince of Wales, afterwards King Edward VII.; and, since this article is mainly concerned with the lighting of the bridge, it is interesting to note that this was provided by Sugg's lamps. Various alterations and improvements to the lighting were carried out from time to time through the years, but as the bascules, which form the central portion of the bridge, are lifted at regular intervals for the passage of shipping, the problem of their adequate illumination had not been satisfactorily solved until the installation of the present scheme.

A HIGHER STANDARD OF LIGHTING.

With the very much higher standards of public lighting now generally adopted, the bridge authorities realised that it was necessary to raise the standard of lighting the bridge in accordance with modern traffic requirements. As the result of experiments and investigations, a system of low-pressure gas lighting employing superheated clusters of small mantles was adopted as being the most advantageous from every point of view, the units employed being designed and tested for their particular purpose in the laboratories of the South Metropolitan Gas Company.

The scheme adopted includes sixty-one lamps of the "South London" and "Grosvenor" types, glazed with bent panes, and each carrying a cluster of six No. 2 mantles. These lamps, which are surmounted by the City Arms device, are carried on columns mounted on the footpath on the south side, and on the balustrades in the case of the north approach. The south side is also provided with two particularly fine

A night view of the lighting of the bascules of the tower, by special flood lamps.

A further night view, showing the approach to Tower Bridge from the northern, or City side. Note the even and pleasing illumination.

examples of illuminated guard posts, lighted, of course, by gas.

THE LIGHTING OF THE BASCULES.

The most interesting part of the installation is, however, the lighting of the bascules, which is achieved by mounting three flood lamps in each of the main towers. These flood lamps each carry six No. 2 mantles, and are provided with special reflectors of chromium-plated copper specially designed by the South Metropolitan Gas Company. In addition, special " armour plate " glass is used for those windows of the towers through which the flood lamps throw their light.

The fine lighting which the flood lamps provide is indicated by the night photograph shown. The installation is completed by the provision of a six-light " Rochester " suspension lamp, with special reflector under each of the main arches leading to the bascules, the light from these lamps illuminating the arches themselves and merging into that from the flood lamps, and also two six-light " Rochester " lamps under the ferry arch on the north side.

THE RESPONSIBLE PARTIES.

The new Tower Bridge lighting is the joint responsibility of the South Metropolitan Gas Company and the Commercial Gas Company. Both are to be congratulated on the results obtained. All the lamps and fittings were made—as at the opening of the bridge nearly forty years ago—by Messrs. William Sugg and Co., Ltd.

Glare and Visibility in Street Lighting

WE have received from L. T. Minchin some further comments on the above question, which formed the subject of recent correspondence in this journal.* He recalls the suggestions that (a) a high candle-power near the horizontal does not matter, and (b) it results in a lower brightness diversity on the road, and thus actually improves visibility.

In this connection he remarks that the present B.S.I. specification has a clause that " the installation must be as free from glare as possible," but this has not prevented a large number of street lighting schemes of an extremely glaring nature being adopted.

As is well known, there are two primary effects of glare—" discomfort " (which can reasonably look after itself) and " disability " (which is a very important factor in street visibility). The importance of disability effect of glare can be readily appreciated by standing in the street, fixing the eye on some small detail, and then lowering the hand so that the direct light from the street lamps is shielded from the eye. A greatly improved clearness of detail will be immediately obvious. Mr. Stiles has deduced a formula† by which this reduction in sensitivity of the eye can be assessed for a street lighting system. Substituting in this the factors for the street under discussion, a glare figure of 5.1 is obtained, as compared with a maximum of 11.0 and a minimum of 2.4 found in Stiles's original survey, of actual installations. The equivalent background brightness is thus reduced by glare to one-fifth of that when glare is completely absent, and at least one-half of that obtainable with practical but less glaring installations.

It is equally dubious, Mr. Minchin contends, that this high candle power on the horizontal is necessary to produce even brightness. The $5\frac{1}{2}$:1 diversity may be the result of a high ratio of height to width of road (in this case 0.83) combined with a suitable road surface. (This view is supported by the fact that Cannon-street, which is lit by centrally suspended high pressure gas has also an exceptionally high $\frac{h}{w}$ ratio (0.87), and the diversity of brightness is actually lower than that of the Watford-road, viz., 4.2:1. It is not claimed that the lighting of Cannon-street, which has not been changed for twenty years, was specially planned to give even brightness!) Actually, it is concluded, glare can only conceivably be advantageous if a lengthening of the " streak " or " lane " of light is required. An examination of almost any street lighting photograph reveals, however, that it is a widening of this streak which is chiefly required, and a lengthening will normally only affect the road in the immediate foreground, where vision is normally satisfactory.

* ILLUMINATING ENGINEER, December, 1933, p. 315.

† ILLUMINATING ENGINEER, July, 1931.

The Influence of Luminous Publicity on the Aspect of Cities at Night

WHAT DOES "LUMINOUS PUBLICITY" MEAN?

THE essential factor in luminous publicity is the application of increased brightness contrasts by means of artificial light, taking as a basis of comparison the natural contrasts of brightness which any publicity matter (either words, or pictures, or an object) does present under daylight conditions.

This increase of brightness contrast has proved to be a powerful means for attracting attention—the prime aim of advertising—until a certain limit is reached, when further increase of brightness and brightness contrasts will lead to glare and consequently reduce the effect.

An additional factor, contributing to the efficiency of a luminous sign, is its contrast against dark surroundings. This contrast, however, is not the essential point for luminous publicity, which can also be used in daytime, provided the surroundings be not too bright!

This article, however, deals especially with luminous publicity at night time, which has already found general recognition as a powerful advertising means amongst those interested in publicity.

Voices have been heard, on the other hand, that are less in favour of luminous publicity. It has been claimed that luminous signs will destroy the beauty of our cities, both at night and at daytime (in the latter case objection has been raised against the structures supporting the signs).

PUBLIC AUTHORITIES AND LUMINOUS PUBLICITY.

Consequently, public authorities have found it their duty to exercise a control on luminous publicity, as far as it is visible from the street.

Considering, first, the objections against the effect of a structure supporting the sign during day-time, everybody will agree that they are seldom attractive or apt to contribute to the beauty of a building. (See fig. 1.) But agreement will also be obtained as to the fact that in business streets luminous signs often do not find much architectural beauty left to be spoiled. In a certain case the authorities have found a solution in ordering the supporting structure to be made collapsible and to be lowered during the day, thus rendering the sign invisible. (See fig. 2.) The cost of such a solution, however, is nearly always prohibitive, and, consequently, there is likely to remain a kind of conflict between the proprietor of a building who wants to erect a sign and the public authorities who have power to prohibit or to impose conditions in order to obtain a more attractive sign during the day-time.

Whenever it is pretended that a luminous sign will spoil the architectural beauty of a building or a city quarter at night, the question may be raised whether such beauty remains visible at all when dusk comes. Street-lighting, as carried out at present, cannot be considered a suitable means for bringing such beauties into relief. If, however, special means have been provided for the effective lighting of such buildings, objections will be rightly made to the installation of luminous signs.

When deciding upon a luminous sign permit the public authorities will try to balance against each other the interest of the applicant and the general interest.

Generally the decision is given from an aesthetical point of view only, the advisers to the authorities being architects. Safety of traffic is not taken into account. Yet, with modern urban automobile traffic largely depending on colour traffic signals, it is very important that coloured luminous signs situated in the direction in which the automobilists look cannot be mixed up with traffic lights.

Above (Fig. 1) is a view of America's famous Broadway, taken by day.

On the right (Fig. 2) is a view of the mechanism used to lower a large Citroen sign in Berlin.

WHAT DOES "LIGHTING ARCHITECTURE" MEAN?

Lighting architecture originated with the Exhibition of Decorative Arts in Paris, 1925, and with the "Gesolei" Exhibition of 1926 in Düsseldorf. Within a few years it became a very remarkable trend in modern architecture. Up to that time artificial light had only been used for the illumination of already existing architectural schemes. Artificial light performed a secondary function only, whereas daylight has had from the oldest times a very important influence on architecture, not only in the shaping and grouping of window-openings for the admission of light, but also in the consideration of shadow as a means for producing brightness contrasts and plastic effects. In lighting architecture, on the contrary, artificial light and its effects on illumi-

Fig. 3. A view of the Titania Palast Cinema in Berlin taken by daylight.

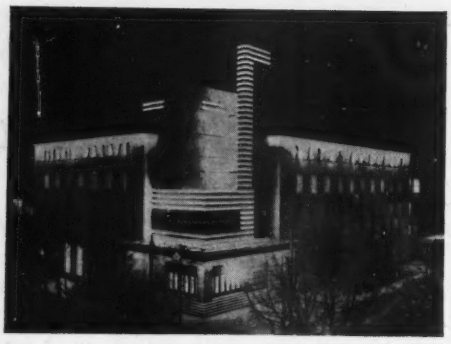


Fig. 4. The same Cinema taken after dark.

nated and transparent surfaces became an essential part of the architect's scheme. This development has put artificial light on the same level as other building materials and elements of building construction. It may be expected, even, that the possibilities of light in this respect go much farther than those of other building materials.

So we may define " lighting architecture " as the art of applying luminous elements (either self-luminous or surfaces transmitting and reflecting artificial light) in the architectural scheme.

In interior decoration lighting architecture has already been applied on a large scale in cases where artificial light has to be used exclusively or to a very large degree, as, e.g., in theatres, cinemas, restaurants, cafés, stores.

As to exterior decoration, the case of exclusive use of artificial light does never present itself. Therefore, when applying lighting architecture to the front of a building, the architect will have to consider both the effect at night-time and the effect at day-time. It is not essential, however, that these should be exactly the same. A certain relation will, however, exist, as a rule. This can be illustrated by the following examples:—

1. Floodlighting a building by projectors. Here the difference between the aspect by day and by night is caused by the different angles of incidence of the light altering somewhat the shadow effects. The most important feature of this type of floodlighting is the contrast to the dark background, which concentrates the attention on the architectural details of the building.

2. The application of luminous surfaces (see figs. 3 and 4). Apart from the contrast of the building against the dark background at night, the difference between the two aspects of this building is small.

3. Contour-lighting by rows of lamps. Only the main architectural lines can be reproduced by this method of illumination. The development of luminous Neon-tubes has paved the way for much improved forms of contour-lighting.

Contour-lighting and floodlighting should be considered as the two extreme cases, limiting the extensive field of modern lighting architecture.

THE INFLUENCE OF LIGHTING ARCHITECTURE ON LUMINOUS PUBLICITY.

Many architects, recognising the possibilities offered by lighting architecture, have started to make use of this modern application of artificial light. They will also, by applying the same principles, find new shapes and designs for luminous publicity, which will be more satisfactory from an aesthetical point of view.

The close relation between lighting architecture and luminous publicity is shown by the following considerations:—

(1) The effect of both depends to a large degree on brightness contrasts and on the contrast created by a dark background.

(2) The large luminous surfaces used in lighting architecture prove to be extremely suitable for applying publicity texts.

The first example, as far as I know, has been the front of the Herpich Store in Berlin (see fig. 6). It is of extreme simplicity. Mendelsohn, the architect, provided cove lighting for horizontal bands, separating the windows of the various floors, thereby providing a place for occasional announcements (and acting as

Fig. 5.

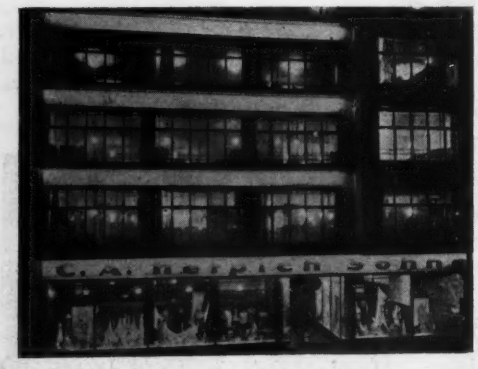


Fig. 6.

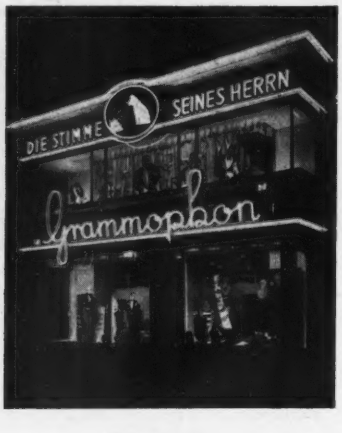


Fig. 7.

luminous publicity at night-time). These announcements of sales, etc., generally do spoil the whole aspect of a store-front.

A more elaborate example we find in the building of a co-operative society in The Hague (see fig. 5). Here the architect, Buys, has provided large surfaces of white glass, lighted from behind, which are used as a bright background for silhouetting all kinds of announcements.

The third example of an interesting combination of luminous publicity (the trade-mark of a gramophone company) and contour-lighting, both by Neon-tubes, is shown as the seventh example, the show-window front of a shop in Berlin (see fig. 7).

The application of Neon-tubes, however, seems not to be limited to contour-lighting. The many ways into which such tubes may be bent opens the way to the production of plastic ornaments, which may be used both as trade-marks and as architectural elements. The Neon-tower on a Tokio cinema (see fig. 8) may be considered as one of the most progressive steps in this respect.

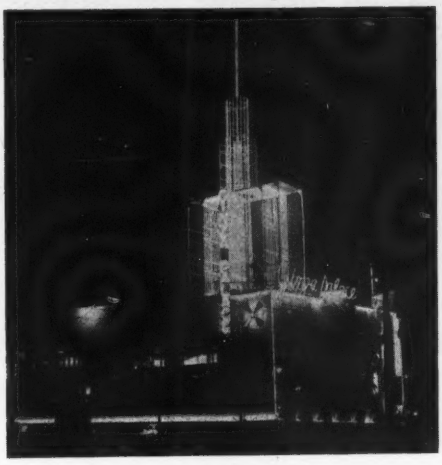


Fig. 8.

Luminous publicity and lighting architecture has already been applied in a combined form in so many buildings in European cities, and lighting architecture itself has already been used in so many cases, especially in view of acting as a kind of luminous publicity, that it is not possible to include a complete survey in this report.

Of all attempts made to bring luminous publicity in a shape which can be accepted by architects, none has been so promising as this introduction of lighting architecture.

It is true that the architectural profession is not yet 100 per cent. enthusiastic concerning this new development. But the fact that, in the short lapse of eight years, lighting architecture has already found so many enthusiastic adherents and able planners, shows the special merits and future possibilities of this movement, which deserves to get the full attention of everybody interested in luminous publicity. Lighting architecture is likely to bring luminous publicity to a higher level, which will, no doubt, be looked upon favourably by the authorities in charge of its aesthetical control.

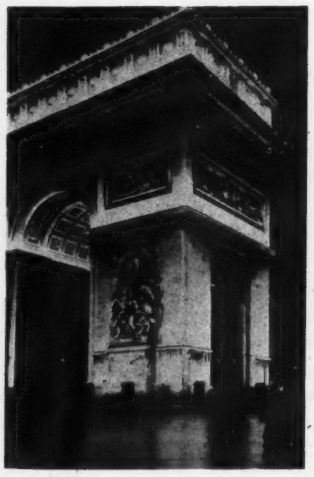


Fig. 9.

LIGHTING ARCHITECTURE AND THE NIGHTLY ASPECT OF OUR CITIES IN THE FUTURE.

Lighting architecture has contributed a great deal to the success of recent international exhibitions (Barcelona, Antwerp, Paris (Colonial Exhibition), Chicago. Such exhibitions always have offered an opportunity for large-scale technical experiments. It is not sufficiently recognised that they have contributed very much to technical progress in this way.

Now lighting architecture has brought about a revolutionary effect in the classical architecture, which was up to now preferred for exhibition buildings.

But it is not only the architecture of exhibition buildings which has undergone its influence, but also a number of accessories, like gates, bridges, pylons, lanterns and lighting fittings.

All these objects have been made luminous in some way or the other, by applying luminous architecture, thereby contributing to a fantastic impression of the whole exhibition grounds at night. Visible lamps and lamp-posts, properly speaking, have now disappeared from the scene.

What has been used with such splendid effect in the temporary installations of exhibitions, will ultimately also make its appearance in a more permanent form in our cities, decorating with light the squares, avenues, and parks.

There is no doubt that public buildings, like town-halls, post-offices, stations, exchanges, etc., are built in a much more expensive way than that which is necessary for their purpose, just for making a city more beautiful. But such beauty can be appreciated during day-time only. During at least 1,000 evening hours a year the extra capital spent for making the city more beautiful seems to have been spent in vain.

The late Fernando Jacopozzi, the unsurpassed expert of luminous publicity, has regained for Paris the title of "ville lumière" by taking the initiative for the flood-lighting of many well-known buildings, like the Opera, the Madeleine, the Sacré Cœur, the Place de la Concorde, and the Arc de Triomphe (see fig. 9). This may be considered as the first example of municipal luminous publicity on a large scale. Monuments, bridges, and the public lighting systems, especially where it is decorative, will in the future be submitted to the influence of lighting architecture. Successful experiments have already been carried out in temporary installations (see fig. 10).

So we may expect lighting architecture to have in the future a far-reaching influence, not only on the luminous publicity, but on the nightly aspect of our cities as a whole.

Fig. 10. A view of the Edison Monument, Amsterdam.

Report for the section on "Luminous Publicity and the Art of Show-window dressing" of the International Advertising Congress, 1933. Prepared by Dr.-Ing. N. A. Halbertsma, Eindhoven, Holland (Vice-President of the International Commission on Illumination).

Light Throughout the Ages

A Fascinating Show for Children at South Kensington

THERE can be no excuse for the modern boy if he grows up without a good working knowledge of lighting matters.

The Science Museum at South Kensington, London, that Mecca of all Christmas holiday schoolboys, has devoted an entire floor to the subject of light in one form or another. Rather inaptly we feel this section of the museum has been dubbed "The Children's Gallery"; we say "inaptly" because the complete science of light, from the rush light of the cave man to gaseous discharge tubes and photo electric cells, appears to have received attention of one sort or another.

There are mysterious cases with apertures, by looking through which one can obtain a clear visual demonstration of the laws of reflection and refraction; there is a convincing tableau of a London street in the year 1750, which shows all too clearly the difficulties of travelling in London after dark when the sole source of light was the flaring torch of the link boy. There is also a series of tableaux depicting lighting methods through the ages, from the rude torch of the cave man to the present day, and these tableaux, each one of which may be "worked" from outside by means of a small switch, hold the many visitors, adult and juvenile, enthralled.

It is a significant fact in this connection that the modern boy is not allowed to look upon incandescent filament lamps, used in conjunction with modern scientific lighting fittings, as the up-to-date method of illumination.

The last tableau of all, intended, one assumes, to represent the *dernier cri* in lighting, shows a room illuminated entirely by a combination of lay lighting and cornice lighting by means of vapour tubes!

From all of these clever models and exhibits two stand out in juvenile popularity—the first a model theatre stage erected at eye level, with a panel in front of it carrying numerous tumbler switches. Each switch controls various lights, some coloured, some white, here one for footlights, here one for floods, and so on, all "working," and all at the disposal of the visitor. There is usually a queue for this model! Second only to this is the wonderful door which opens and shuts itself with uncanny prescience when approached. This demonstration of the magical properties of the photo electric cell continues tirelessly and endlessly as more and more uninitiated brothers and uncles are induced to approach it.

There we will leave the "children" experimenting with their rays and incident angles while we go upstairs to gaze in honour upon the famous old Rocket, one of the earliest of steam engines, and, even so, only a little over a hundred years old! Will another generation of "children" come here in the year 2034 and smile tolerantly at our proud inventions as we do at those of our forbears?

Assuredly they will, for progress is inevitable, and the innovation of to-day is the commonplace of to-morrow.

The Physical Society's 24th Annual Exhibition of Scientific Instruments and Apparatus

THE Physical Society's annual exhibition of scientific instruments and apparatus was held at the Imperial College of Science and Technology on January 9, 10, and 11, and a brief visit proved that this year's exhibition was in no way inferior to its many predecessors.

The keynote of novelty of this exhibition appeared to be the many and varied uses to which the photo-electric cell and the cathode ray tube have been put since their commercial production a few years ago. In the trade section were seen many examples of recent developments and improvements in electrical indicating instruments, galvanometers, radio frequency apparatus, relays, pyrometers, thermostats, humidity measuring apparatus, recorders, controllers, and meters of many kinds, microscopes, projection and cinema apparatus, and so forth.

We noted many specially interesting exhibits, such as a new form of glarometer, due to Dr. Stiles, a device for examining the finish of transparent or reflecting articles, a semi-automatic light distribution photometer, a ballistic valve voltmeter, and a great variety of the usual electric recording and measuring apparatus.

Altogether this twenty-fourth exhibition of the Physical Society was most interesting and well worth the time spared for a visit.

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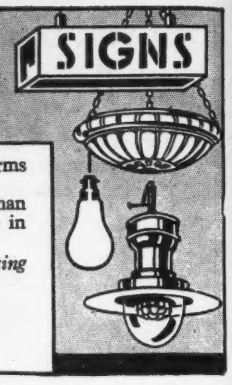

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National Physical Laboratory Papers Read and Published

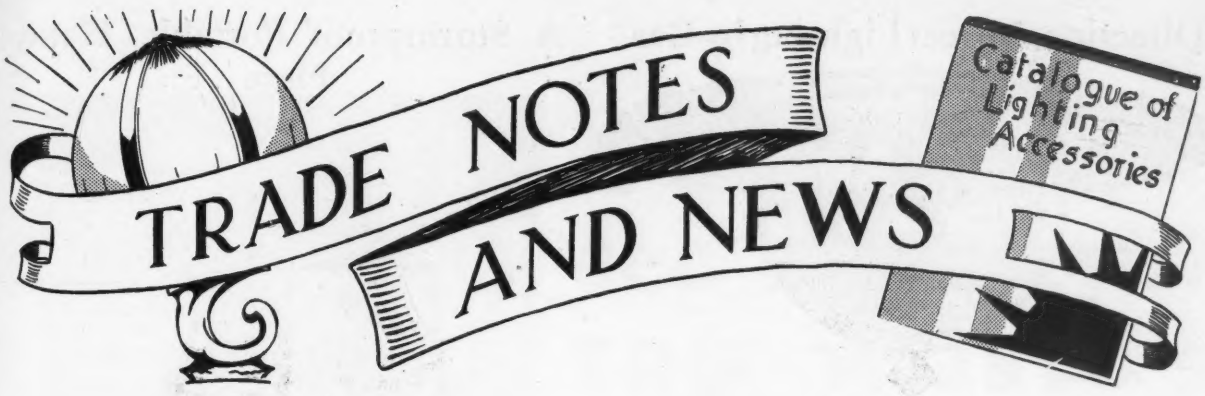
Our attention has been drawn to a new departure by the National Physical Laboratory, the circulation of monthly lists of papers read and published by those associated with the Laboratory. The first of these lists, relating to December last, contains ten items. As might be expected, they cover a wide range of subjects. We notice amongst them Mr. Preston's excellent paper on Dock Lighting, which appears in this number (pp. 39-44). The distribution of these monthly lists seems to us quite a useful step. It will naturally happen sometimes (as in this case) that only one or two items are of direct interest to the recipient. But most specialists will nevertheless welcome the lists so as to be sure of not overlooking the items they chiefly value, whilst to those whose work involves a wide range in science and engineering the lists should prove invaluable.

A New Type of Lamp Standard

A new and effective street lamp standard for the illumination of tree-lined streets has recently been tried out in the Avenue, Redhill Park, Bournemouth, where Mr. C. H. Woodward is the Public Lighting Engineer. The standard is so constructed that the bracket carrying the lamp itself may be swung around the supporting pillar.

In this way the lamp may be swung out over the road and clear of the trees while in operation, and may then be swung back so that the lamplighter can make necessary adjustments out of the danger of passing traffic.

The system is one which has a great deal to commend it, especially in rural or provincial districts, where the roads are frequently tree lined.

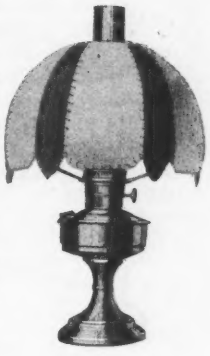


Lighting in London Docks

No hard and fast rules have been laid down concerning the lighting of docks, save that a high and even intensity of light is required with complete absence of filament glare.

The above photograph illustrates a section of the London Docks illuminated by Kandem "Throlite" lanterns, which seem to have complied with all the above requirements and to have achieved a suitably wide distribution as well.

Aladdin Up-to-Date!



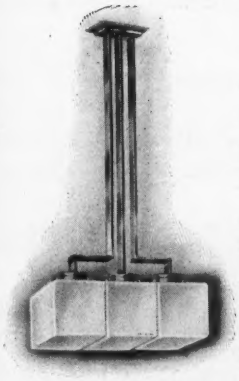
From Aladdin Industries, Ltd., of Greenford, who are, of course, familiar to our readers as manufacturers of high-class electrical and paraffin lamps, we have received for review one of the latest Super Aladdin Table lamps. The lamp, which is decidedly good looking in its design, is supplied in six alternative finishes which range in price from 42s. in nickel plate, satin, or polished brass, to 60s. for the same lamp finished in oxidised silver.

The manufacturers claim a m.s.c.p. of 120 for this lamp, and, of course, in common with all the new Aladdin lamps it has the exclusive features of the entire absence of smoke or smell—instant lighting without preheating, the utmost simplicity and safety of operation, and, of course, complete economy.

The running costs of the lamp are given as ¼d. per hour.

We hope to be able to give a more extensive review of the Aladdin products in a forthcoming issue.

British-made Glassware



One of the many combinations of cube fittings, in this case a three-light pendant.

From Messrs. Hailwood and Ackroyd, Ltd., the well-known makers of glassware in its many forms, we have received a brief but interesting list of some of their latest products. These include many forms of the new cube and sphere diffusing glass fittings of which one sees such large numbers used for decorative lighting purposes.

Electrical Equipment for London's Underground

No one can have failed to notice with growing interest the great progress made in the last few years by the London Underground Railways.

New stations, new services, new escalators, and automatic ticket machines, all have sprung up like mushrooms, so that the newly returned traveller, albeit he has only been abroad for five or six years, finds this mode of travel changed almost beyond recognition.

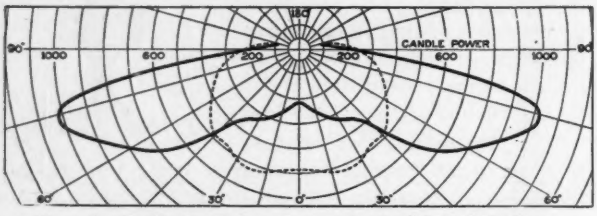
A remarkable brochure which we have recently received, which is issued by the B.E.A.M.A. of Kingsway, London, W.C.2, reveals, in over eighty fascinating pages, all the details concerning the electrical development which has taken place in the railways. Everybody who is interested in this important feature of modern life should secure a copy of this book and read it for themselves.

Directional Street Lighting by Gas

As is well known, the distribution of light from the normal gas street lamp, is mainly in a downward direction, in fact it is safe to say that, unless special equipment is used, there is little or no upward component of light.

That being so, it is impossible to control the light by means of reflection alone, and the latest system for controlling the illumination comes from Holophane Ltd., whose two-way refracting dish is illustrated above. This " dish," which consists of a scientifically designed glass refractor, fits into the base of an existing gas lamp as shown; the resultant alteration in distribution being clearly shown in the diagram below. Refracting units are also available for other types of gas lanterns.

In all cases the object is to spread the light longitudinally along the road and so to avoid " patchiness."



Note the distribution before the introduction of the Holophane Refractor (dotted line) and after (thick line).

Improved Street Lighting at Clacton-on-Sea

By courtesy of the " Electrical Review."

Considerable improvement has lately been made in the street lighting of Clacton-on-Sea, and our photograph shows a portion of the new scheme in use. The Committee responsible, and their Engineer, Mr. G. Broadhurst, A.M.I.E.E., are to be congratulated on the excellent results obtaining from their far-sighted policy.

The lighting fittings were specially designed and supplied by the Revo Electric Co., Ltd., of Tividale, Tipton.

A Stormproof Portable Hand Flare

The above illustration graphically illustrates the manner in which the new " H4 " Portable Acetylene Floodlight, manufactured by C. S. Milne and Co., Ltd., of Deptford, London, S.E.8., can be carried around by one man. The weight fully charged is only 24 lb., and the lamp gives a brilliant flood of light for six hours on one filling of 3½ lb. of carbide.

Catalogues, etc., Received

From the BENJAMIN ELECTRIC LIMITED, of Tariff Road, Tottenham, N.17.

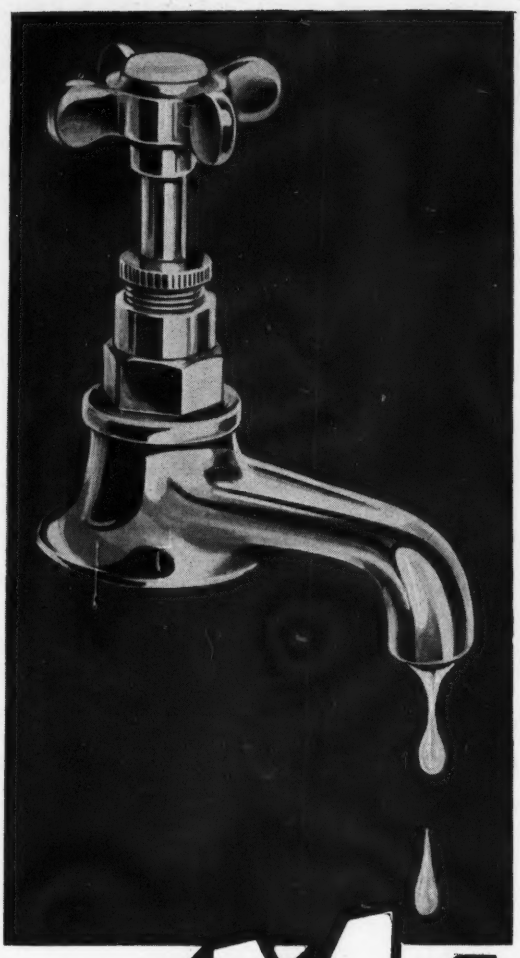
A copy of the new Benjamin Catalogue No. 1400, aptly titled " Artificial Lighting." Every aspect of modern industrial and commercial lighting is touched upon in addition to full Catalogue details. 180 pages of useful information.

From MESSRS. DAWSON AND HENCKEL, of 42, Grays Inn Road, W.C.1.

A brief leaflet describing the " Dawson " silvered glass reflectors and the " Dawsonday " silvered daylight glass reflectors.

From the GENERAL ELECTRIC LIMITED, of Magnet House, Kingsway, W.C.2.

A comprehensive brochure dealing with floodlighting. Many installations are shown, together with much useful data on the general subject of floodlighting. Effectively produced, with coloured illustrations; a most useful publication.



You can see a leaky tap waste water, but you can't see a "cheap" lamp waste current.

USE **MAZDA LAMPS**

and get all the light for which you pay.

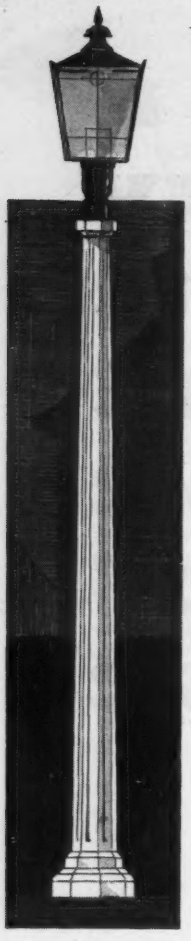
B T-H

Made in England by The British Thomson-Houston Co., Ltd.

PIONEERS OF GOOD LIGHTING

3492 A.

Reinforced Concrete for Street Lamp Columns



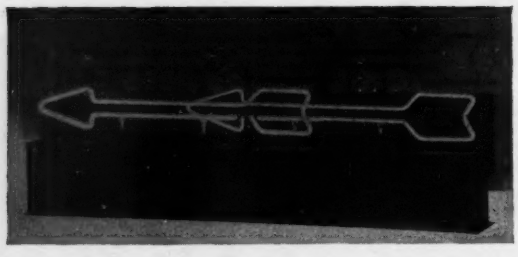
The choice of a suitable support for Street Lamps is one which is of great importance from every point of view. The authority responsible must satisfy himself as to the durability, appearance, and robustness of the columns, while at the same time he cannot afford to lose sight of the important factor of economy.

Reinforced concrete columns for street lamps are claimed to possess the following advantages: They do not suffer from corrosion, as is so often the case with steel pillars; they do not snap when subjected to a heavy blow, as cast iron pillars are apt to do; and they do not deteriorate with the passage of time.

The illustration is of a reinforced concrete lamp column, manufactured and supplied by Concrete Utilities, Ltd., whose products, introduced to the market over three years ago, are now, thanks to their extensive applications, well known all over the country.

With the rapidly increasing amount of new street lighting which modern road conditions are bringing about, there should be an immense market for these products.

A New Type of Neon Sign



An interesting Neon product, of which we have received particulars from Neon Manufacturers, Ltd., consists of a " Shooting Arrow Sign," as illustrated above.

The system consists of two " arrows " which are connected to a flasher. By means of this flasher the arrows light up alternately some one hundred and eighty times a minute, and the whole effect is that of a flaming arrow in flight.

It is unnecessary to emphasise the advertising value of these signs; they are ideal for suspension outside shops, showrooms, cafés, cinemas, etc., as they can be incorporated in a lighted box sign, bearing illuminated lettering. These signs are weatherproof and foolproof, and are guaranteed for a year from the date of installation. They are obtainable in two sizes at prices of £9 15s. 0d. for a sign three feet long, and £12 for a sign five feet long.

We understand that particularly advantageous terms are available to the trade.

The Ideal Homes Exhibition

From advance details recently received we gather that the chief feature of the Ideal Homes Exhibition for 1934 will be a " City of Steel." Non-corrosive steel, of which " Staybrite City " will be constructed, is rapidly making its way into the home for purposes of both utility and decoration, we are told. This statement naturally raises the question of the effect of quantities of bright reflecting surfaces on the eyes. Eyestrain and fatigue may take their toll in the home just as much as in the factory or office. The growing increase of the use of bright steel in the home therefore makes it incumbent on the manufacturers of domestic lighting fittings more than ever to ensure that lighting shall be glareless. We shall look forward to seeing how this problem is dealt with at the Exhibition.

Architects' Conference

An address on " Lighting Principles and Economics " was read by Mr. W. J. Jones at the first of the 1934 series of Conferences for Architects, which are being held fortnightly at the Lighting Service Bureau of the Electric Lamp Manufacturers' Association.

Mr. Jones emphasised the purpose of the bureau as one of assistance; he further stressed the increasing tendency for the engineer and the architect to co-operate in lighting matters.

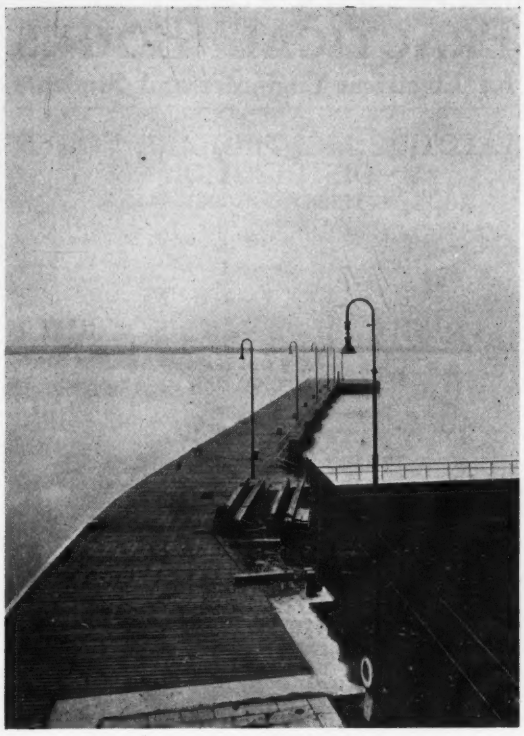
Mr. Jones's interesting paper was supplemented by numerous demonstrations—illustrating the value of an appeal to the eye. The questions of contrast, shadow formations, colour variations, glare, light distribution, were discussed, and the lecturer then dealt in detail with the economics of light, showing the comparison in terms of current and lamp cost between cheap and inferior lamps and standard types made by firms of repute.

New Philips Factory

Every day brings further proof that business is definitely on the up grade. We now learn that Messrs. Philips Lamps, Ltd., are erecting their third factory building.

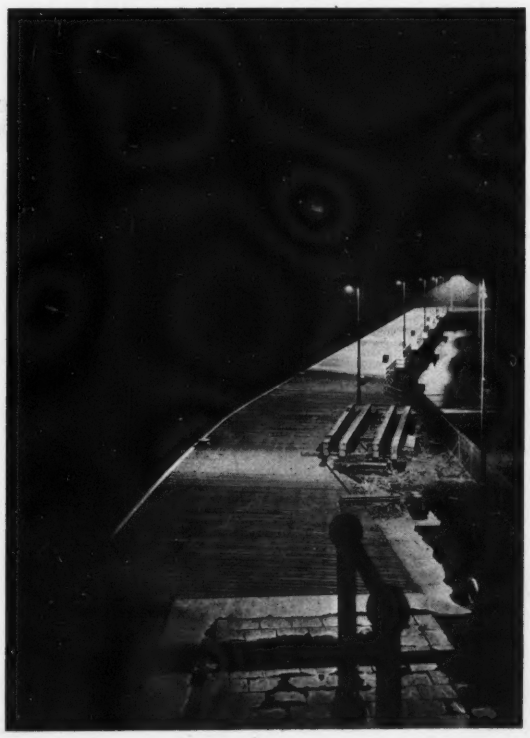
On Friday, January 19, the son of the works manager laid the first stone of a new factory which will give employment to approximately 1,000 people.

We learn that many innovations will be added to the equipment of this factory which will tend still further to improve efficiency and general working conditions.



G.E.C. Dock Lighting at the Port of London

Two interesting views of part of the extensive G.E.C. lighting scheme at the Port of London. The view above shows a daylight view of a lock entrance pier at Tilbury, and the G.E.C. Dock Navigation Lanterns may be clearly seen. The view below is taken at night, and illustrates to advantage the even distribution of the light and the abrupt cut-off at the water line, a most important feature.



Contracts Closed

THE GENERAL ELECTIC COMPANY, LIMITED.
The General Post Office—for 90,000 Robertson Carbon Filament Lamps for Telephone Switchboards.

THE EDISON SWAN ELECTRIC COMPANY.
Contract from the Admiralty in respect of the supply of high-wattage gas-filled lamps.

Change of Address

We are requested to publish the following:—

"On December 4, 1933, the head office of EDISON SWAN CABLES, LTD., was transferred from Queen Victoria Street to

155, Charing Cross Road, W.C.2.,

where all communications should be addressed.

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